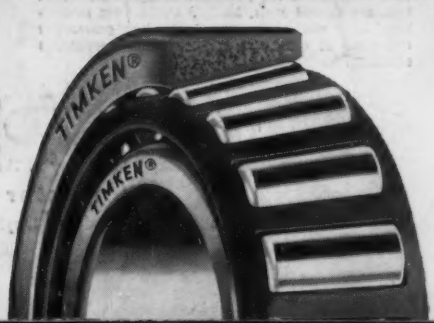
NOVEMBER 1955—SIXTY-SECOND YEAR

MACHINERY

America's best-known bearing
is No. 1 for Value

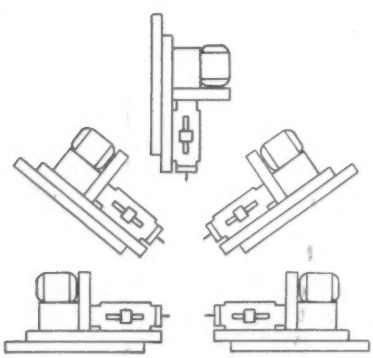


A NEW HIGH IN PRODUCTION EFFICIENCY

new

HEALD SLIDE UNIT BORE-MATICS

approach any borizing problem
from the **RIGHT ANGLE**



Slide Units can be easily arranged to approach the work from any desired angle. Multiple stations can be combined on a single base with identical or consecutive operations at each station, for maximum production efficiency.

With the new line of Heald Slide Unit Bore-Matics, the machine can be adapted to the work—not the work to the machine. For these compact, hydraulically operated Slide Units, complete with boringhead and drive, can be arranged to approach the work from any desired angle—vertically, horizontally, or at any inclination best suited to the operations being performed and the nature of the work. That means greater adaptability to your specific job requirements. It means more efficient floor-to-floor cycles and higher production per machine-hour.

The two-station Vertical shown above is a typical example of modern Slide Unit design—boring, facing and chamfering aluminum torque converter housings at 88 parts per hour, gross. For the newest developments in precision finishing, IT PAYS TO COME TO HEALD.

THE HEALD MACHINE COMPANY
Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts
Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

HEALD

Send for Bulletin 2-25-M

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MACHINERY

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The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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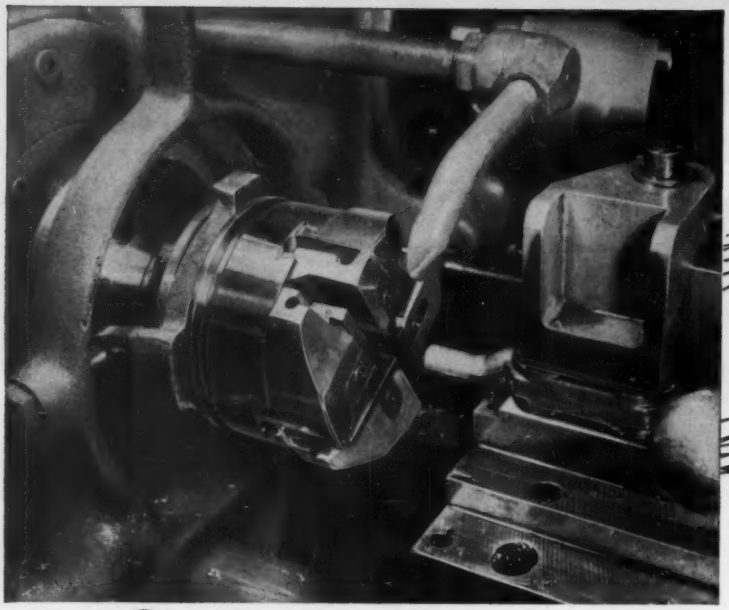
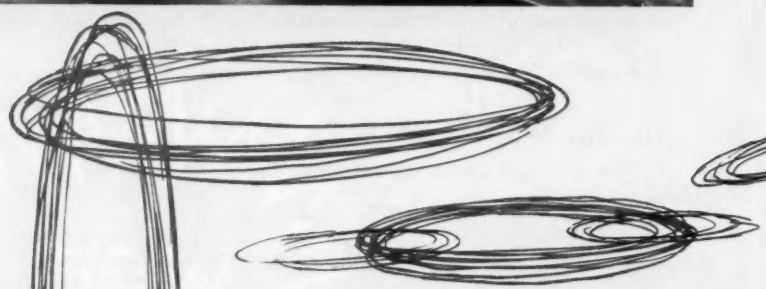
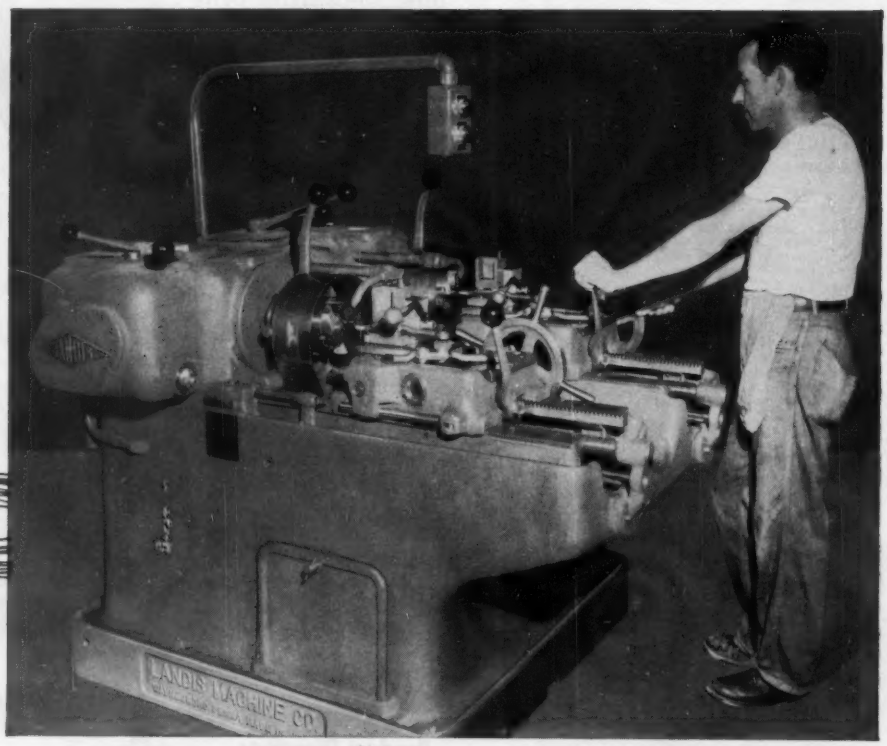





LANDIS MACHINE CO.

FASTER TURNING

Using 4 Cutting Tools

SIMULTANEOUSLY

Automotive parts production at Thompson Products in Detroit has been substantially increased by turning, facing, and chamfering on Landis Threading Machines. This LANDIS **Hollow Milling** technique makes large out-put increases possible by applying a number of simultaneously-functioning cutters, thus multiplying the feed rate of a single tool.

The illustrations show one of these parts, steering links, being turned and faced on a LANDMACO Double-Spindle Leadscrew Threading Machine. SAE 1040 steel forgings are turned (1/32" stock removal) 1⅛" in length and faced by four special turning cutters in ⅞" V LANCO Hardened and Ground Heads. Production regularly averages 200 pieces per hour, with the ⅝" turned diameter held within ±.004". Four hours production is obtained between cutter grinds.

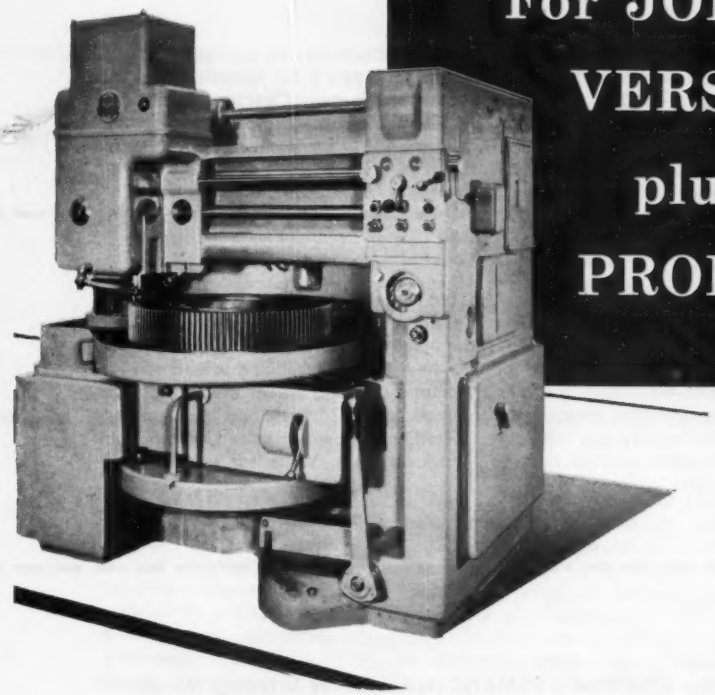
This LANDIS technique offers important advantages over other methods of turning, forming, and facing. The use of four or six simultaneously-functioning cutters, in addition to increasing production, reduces tool cost and workpiece spoilage to the minimum. The diametrically-opposing cutters evenly distribute cutting strains and maintain proper work alignment. LANDIS Cutters, available in a wide variety of styles, are economical for they are usable for most of their length with only a simple regrinding of the rake angle.

Additional information will be sent on request—please include specifications when writing.

THE WORLD'S LARGEST MANUFACTURERS OF THREAD GENERATING EQUIPMENT

LANDIS Machine CO. WAYNESBORO PENNSYLVANIA

THE
PRECISION
LINE



For JOBBING VERSATILITY plus HIGH PRODUCTION

HERE'S versatility that pays dividends. For the Fellows 36-Type Gear Shaper has real "earning power"... whether used to handle virtually every job that comes up in a small gear department... or concentrated upon the heavy work in a large production shop.

A powerful, ruggedly constructed, heavy duty machine, the 36-Type can take extra heavy cuts at high speed... yet hold close limits. Low set-up time, fast gear-shift change from heavy to fine feed, quick dial adjustment from one cutter-spindle speed to another... these are just a few of the ways the 36-Type keeps down costs.

Ask your Fellows Representative to explain *all* the profit-making advantages built into the 36-Type... as well as the Fellows Plan for deferred payment. Write, wire or phone any Fellows Office!

THE FELLOWS GEAR SHAPER CO., Head Office and Export Dept., 78 River St., Springfield, Vermont
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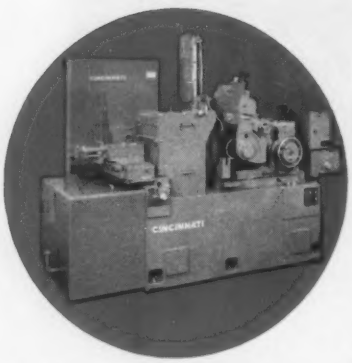
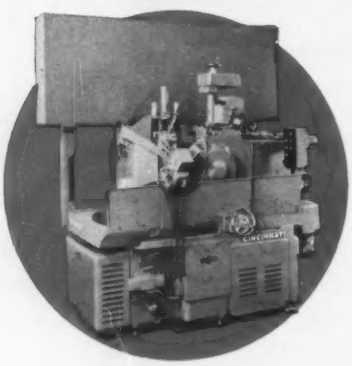
Fellows *Gear Production Equipment*

1205 review of CINCINNATI — exhibited at

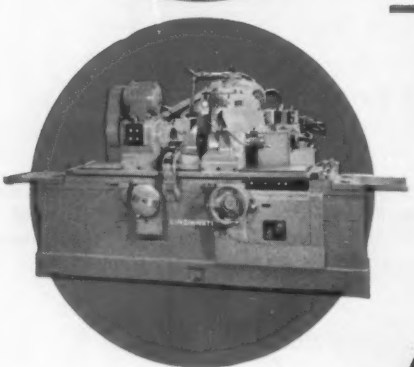
Did you see everything at the recent Machine Tool Show? Did you see how the new equipment could improve quality and reduce manufacturing costs for your products? In the event that you missed something, or perhaps stayed on the job, you'll be interested in this review of six new Cincinnati Filmatic Grinding Machines spotlighted from Cincinnati Milling's 43-machine exhibit.



New CINCINNATI FILMATIC No. 3 Centerless Grinding Machines are completely new from the floor up. Cost-reducing features include anti-friction lower slide; infinitely variable regulating wheel drive; power profile grinding wheel truing; stabilized infeed screw. Extra equipment includes automatic grinding wheel balancing and bar grinding attachments for work up to 24 feet long. Many other attachments are available, including Automatic Infeed, Feedmatic Hoppers, various types of Workrests, etc. Write for catalog No. G-664.



New CINCINNATI FILMATIC Micro-Centric Grinding Machines, like their predecessors, perform the miracle of combining high production with working gage accuracy. New Micro-Centric features include magnetic drive plate which greatly reduces loading time; front handwheel control with fine and coarse adjustment positions; machine mounted cabinet for complete and accessible electrical controls. Ask for catalog No. G-662.



New CINCINNATI FILMATIC Semi-Automatic Angular Wheel Slide Grinding Machines drastically reduce the cost of precision cylindrical work requiring accurately ground diameters and adjacent shoulders. Both are completed in one automatic infeed cycle. These machines, built in 6"R, 10"L, 10"R and 14"L swing sizes, are equipped with Automatic Grinding Wheel Balancing. Get your copy of catalog No. G-647.

CINCINNATI

CINCINNATI

FILMATIC GRINDING MACHINES the Show...

FILMATIC

New CINCINNATI FILMATIC Plain Hydraulic Grinding Machines are more convenient to operate and more accurate in performance than ever before. In addition, Automatic Grinding Wheel Balancing, a feature that will pay off handsomely in your shop, is included with standard equipment. The following types of production equipment are available: Push-button Automatic Infeed Attachment; Automatic Gap Eliminator; Behind-the-wheel Profile Truing; Automatic Electric Gage Sizing with Automatic Compensation. Get the complete story in the following catalogs . . . 6″R and 10″L machines, G-660; 10″R and 14″L machines, G-661.

New CINCINNATI FILMATIC 12″, 14″ and 18″ Hydraulic Universal Grinding Machines. New features of productivity and accuracy are incorporated in the new CINCINNATI FILMATIC 12″, 14″ and 18″ Hydraulic Universal Grinding Machines. Pick feed rates are infinitely variable, and may be engaged at the right, left, or both ends of the stroke; the footstock spindle is now chromium plated to prevent wear; headstock speeds are selected with an easy-to-turn dial; rapid cross traverse feature available. Want more information? Ask for catalog No. G-663.

New CINCINNATI FILMATIC No. 2 Cutter and Tool Grinder. Good News—FILMATIC has been added to the name of another Cincinnati machine tool . . . CINCINNATI FILMATIC No. 2 Cutter and Tool Grinder. These famous machines are now equipped with a lifetime spindle unit incorporating FILMATIC bearings. You'll like these features, too . . . the main drive motor is more powerful (1 hp) and built into the wheelhead; the slenderized column requires less floor space; ways for anti-friction slide are hardened and ground. Complete data in catalog No. M-1914.

Of course, Cincinnati builds many more precision grinding machines and cutter and tool grinders than those illustrated here: six Centerless Grinders; Plain, Universal and Roll Grinding Machines from 4″ to 60″ swing; four Cutter and Tool Grinders, and special grinding machines. There's a size, type and style for your requirements. Would you like to have more information? Write for catalogs on the machines in which you are interested.

THE CINCINNATI MILLING MACHINE CO. • CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

EXTRA!
EXTRA!

VAN NORMAN ANNOUNCES

New Ram Type Miller No. 16S

Features

QUILL Adjustable CUTTERHEAD

Gives Work-Ability of Two Single Purpose Milling Machines...

PLUS...

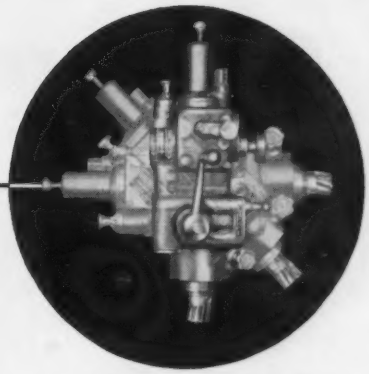
Accurate Boring and Drilling with the Same Machine without Attachments

Don't wait . . . for extra profits install a Van Norman now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to 5 years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

Lease and Conditional Sales Contracts not available to Export

VAN NORMAN

MANUFACTURERS of—Ram Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.



Quill Adjustable Cutterhead makes the No. 16S the most Versatile Miller Available

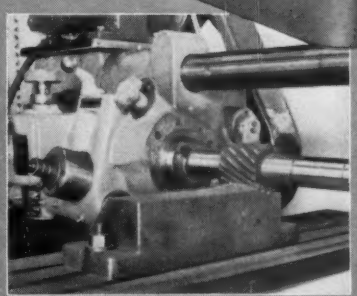
Permits Horizontal, Angular and Vertical Milling, Boring and Drilling on ONE MACHINE.

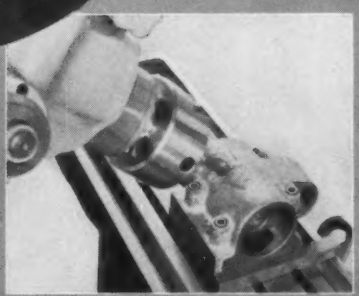
Phone, wire or write for more information and catalog giving complete details.

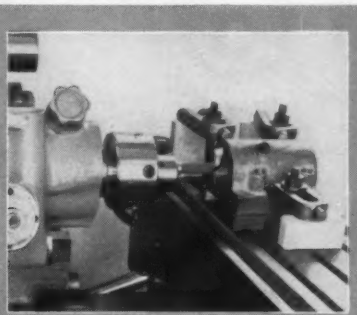
No. 16S...

4″ Quill Travel; 3 Quill Feeds; .0015, .003, .006; 8 Spindle Speeds; 110 to 3600 RPM; Table Size 40½″ x 10″; Cutterhead Spindle Motor 2 HP

HERE'S HOW IT WORKS...







A HORIZONTAL MILLING
A horizontal milling cut performed on a cast iron base. Width of cut 2¼″; Depth .25″; 3″ wide helical slab milling cutter; Speed 110 RPM; Feed 6 IPM.

ANGULAR BORING
Angular boring on a cast iron saddle bracket boring a 1″ dia. hole. Depth of bore 1¾″ removing ⅛″ stock on roughing cut. Finish cut removes .010″; Tolerance on I.D. .001″.

HORIZONTAL COUNTER BORING
Horizontal counter boring operation of a 3″ dia. hole on same saddle bracket. Depth of cut 1″ to a shoulder removing approximately ⅛″ on rough cut. Finish cut .010″; tolerance on I.D. .001″.

COMPANY

SPRINGFIELD 7, MASSACHUSETTS

Features that reduce cost . .

Landis 10" x 36" Type CH Plain Grinder

LANDIS

precision grinders

. . increase operator output

FAST STOCK REMOVAL

"Rigidized" Microsphere bearings and spindles increase production by heavy cuts without loss of finish and accuracy. A Landis exclusive.

SETUP TIME REDUCED

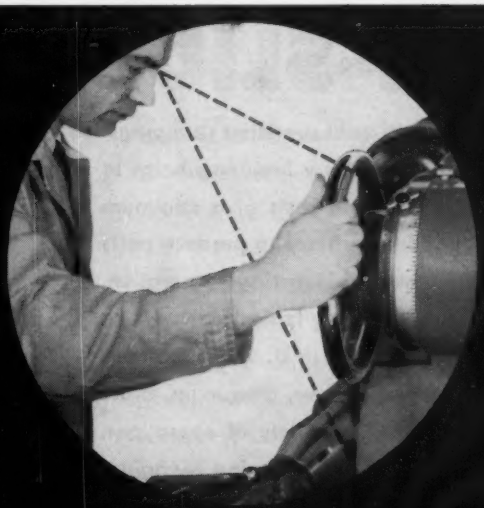
Centralized controls speed setup to give more production time. Controls handy for operator save motion and reduce fatigue.

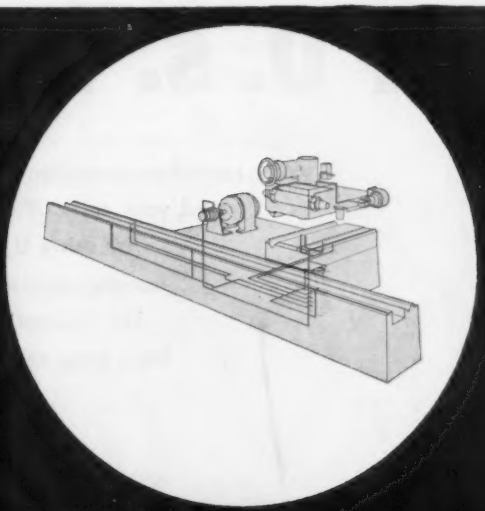
EYE LEVEL WHEEL FEED

The wheel feed is at eye-level—Easy for operator to watch grinding and wheel feed graduations without moving.

PROTECTED LUBRICATION

Automatic spindle and way lubrication for dependable operation and machine protection. This is a schematic diagram.





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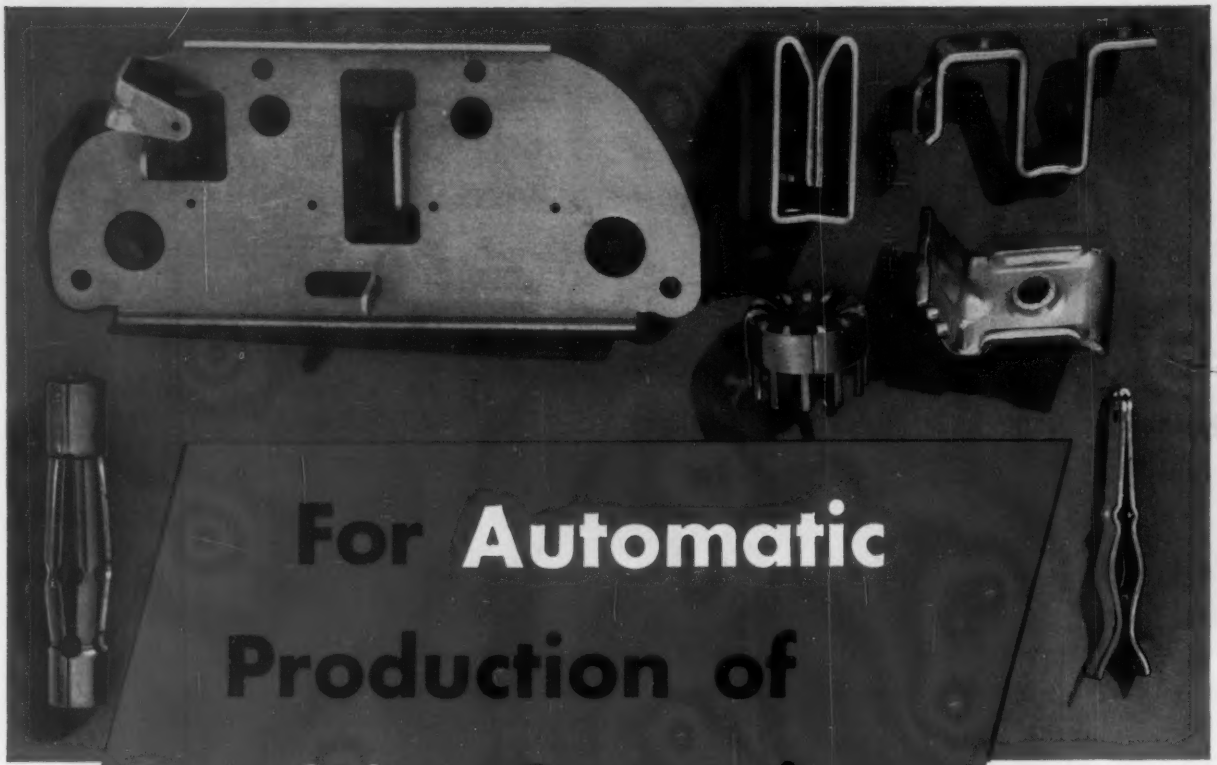
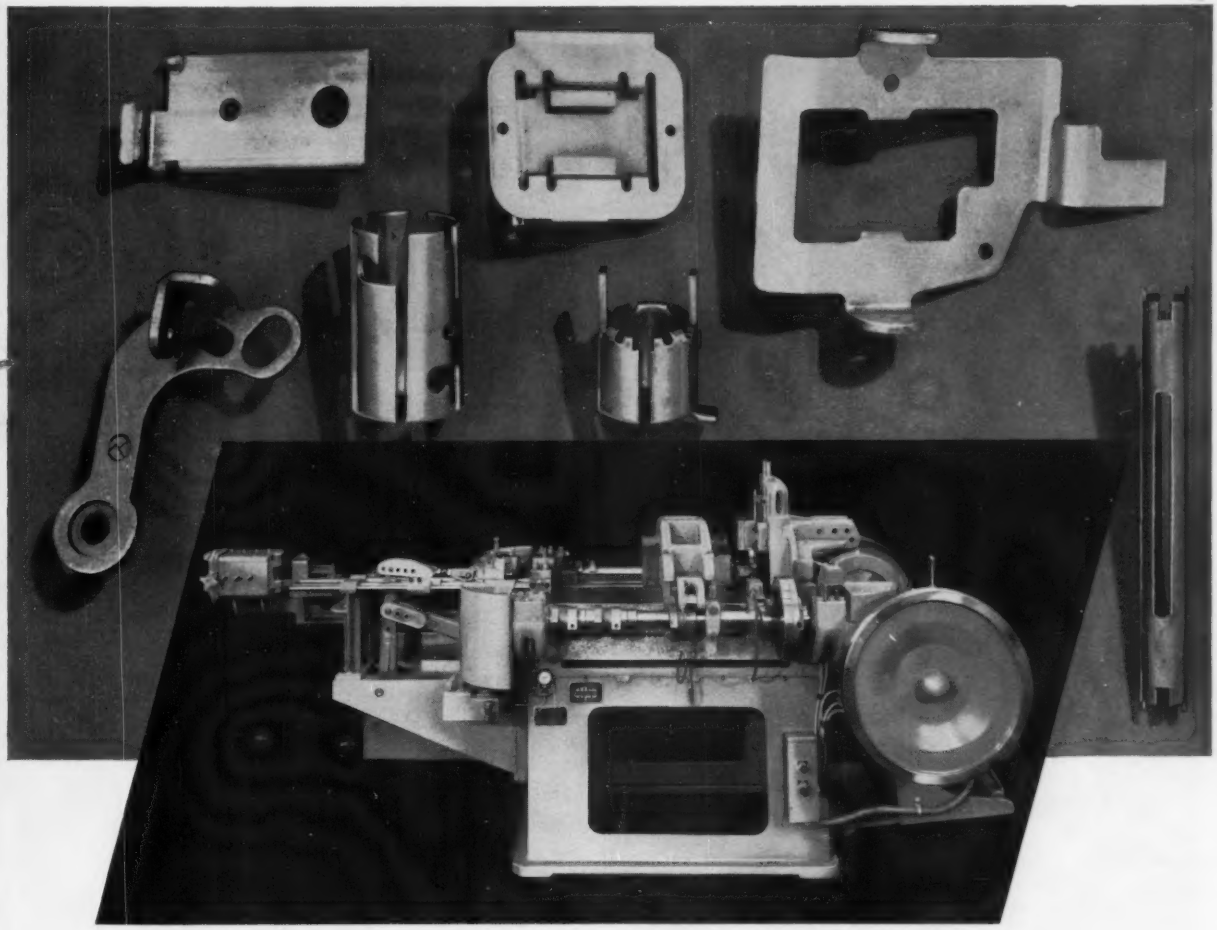


For Automatic Production of Precision Stampings

THE U. S. MULTI-SLIDE®

In the production of precision stampings, every secondary operation, every inspection, every handling helps to send your costs UP! You can keep these costs at a minimum by using U. S. Multi-Slide Machines to produce parts rapidly, accurately, and complete in a single operation. The illustration above shows some typical parts which have been produced in this manner in U. S. Multi-Slides. These parts—of copper, aluminum, brass and steel—illustrate the variety of operations, including piercing, trimming, swaging, coining, blanking and forming, which can be performed in any combination in a U. S. Multi-Slide.



The No. 33 U. S. Multi-Slide, with capacity for material up to 2½" wide, feed length adjustable up to 12½".

Many of these parts formerly required costly secondary operations and intermediate inspections. Now they are produced uniformly and to close tolerances in a single high-speed operation.

U. S. Multi-Slides are built in four sizes.

Illustrated is the No. 33 Machine, with capacity for material up to 2½" wide and feed length adjustable up to 12½".

If your program involves the production of precision stampings, investigate the labor-saving, time-saving features of U. S. Multi-Slides. Ask for a copy of Bulletin 15-M containing complete specifications.

U.S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides — U. S. Multi-Millers

U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories

NOW!... Norton Offers Further Automation

in Cylindrical Grinding

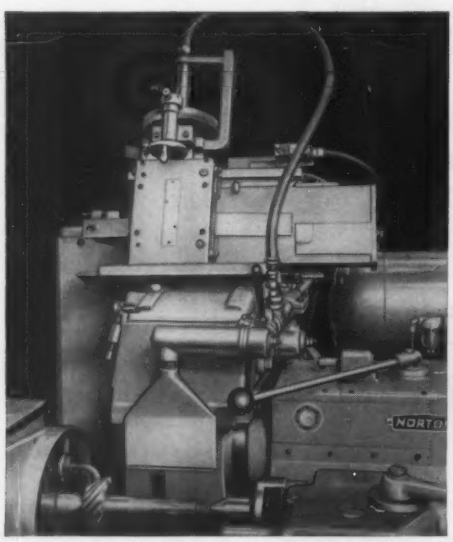
Automatic loading and wheel truing in Type CTU cut the time, work and costs of grinding small shafts.

Automation made one of its most spectacular advancements when Norton brought out the automated crankpin grinder — the sensational machine that adjusts, grinds, gauges and transfers entirely automatically.

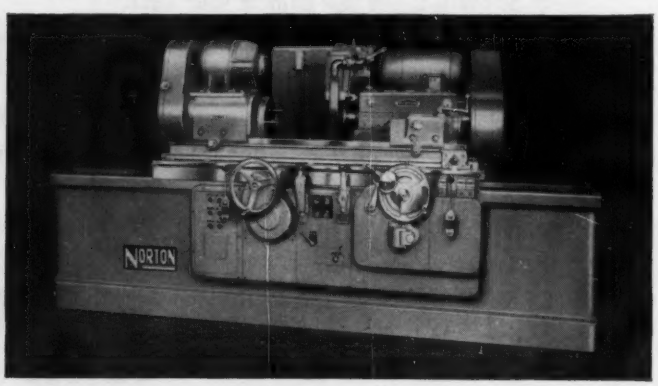
Now Norton is happy to announce further news-making progress in this field. To cut the production time and costs of grinding small shafts, new Norton Type CTU Semiautomatic Cylindrical Grinders may now be equipped with automatic loading. Combining this new feature with automatic wheel guard type truing makes this machine fully automatic in operation.

Thus the fastest, most economical and versatile grinding machine of its type is stepped up to new heights of efficiency.

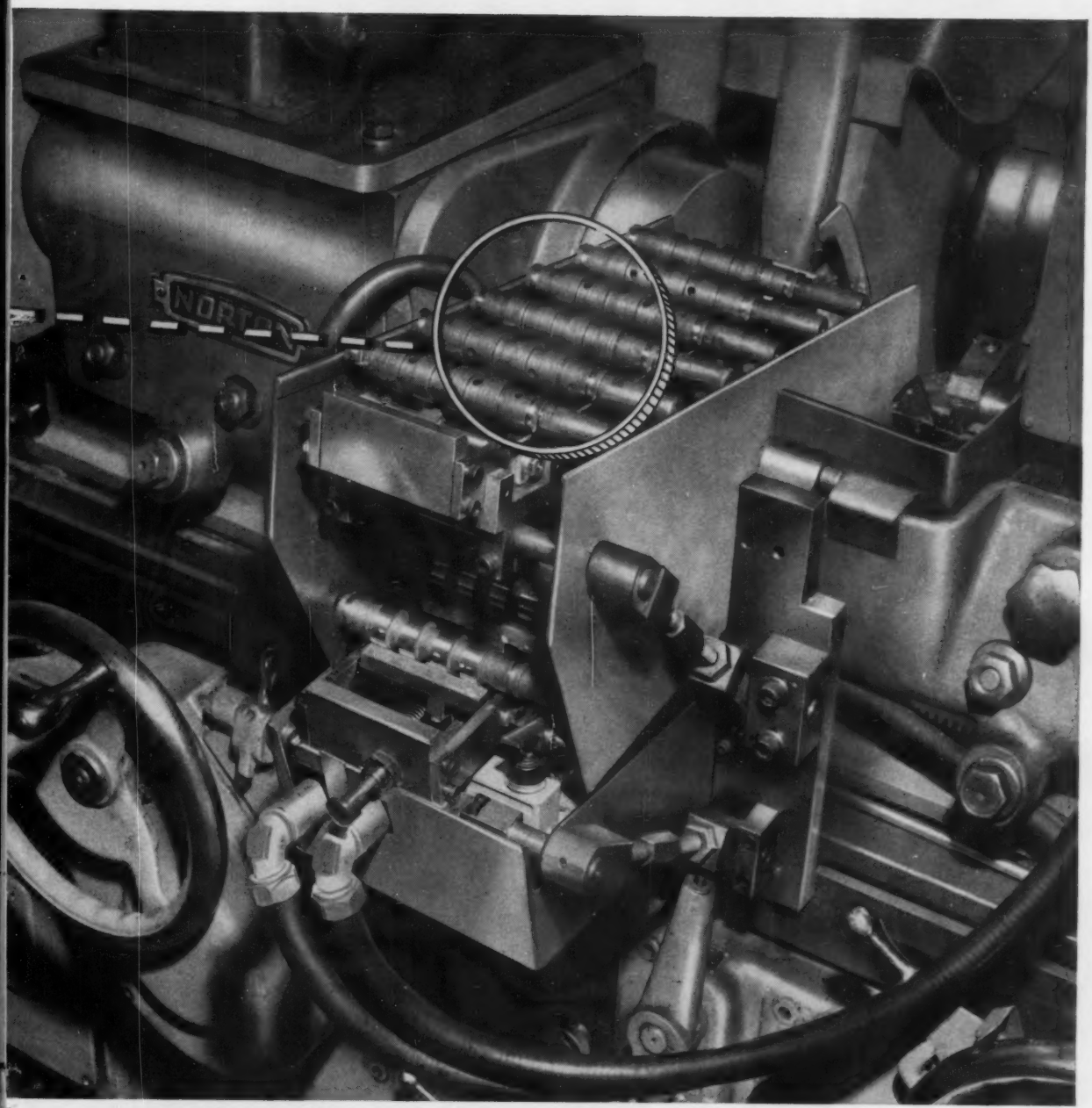
Why not see your Norton Representatives for complete facts on how these and many other advanced features of the Type CTU grinder can benefit your own production? Or write us direct. And remember: only Norton offers you such long experience in both grinding machines and wheels to bring you the "Touch of Gold" — to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.



LESS TIME, WORK AND SKILL ARE NEEDED with the Norton wheel guard truing device, a feature of many types of Norton grinders. Shown here on the 10" Type CTU, it functions completely automatically whenever truing is necessary. In so doing it increases production, wheel life and diamond life.



This 10" Type CTU Semiautomatic Cylindrical Grinding Machine, and the 6" size, are now available for automation with Norton-engineered automatic loading and wheel truing advancements.



ANOTHER NORTON MILESTONE IN AUTOMATION. This automatic loading device, latest Norton development for 6" and 10" Type CTU Semiautomatic Cylindrical Grinders, speeds the production and cuts the unit costs of grinding small shafts. Its steadily paced, automatic operation enables a single operator to tend a battery of machines.

The device is adaptable to a variety of these parts, which are rolled by gravity on inclined rails. Latches between the rails separate the shafts and are arranged to release only a single workpiece at a time to the turret, which is carried on a hydraulically controlled swinging arm.

When the workpiece rolls into the turret the arm swings the turret to locate the piece in line with the work centers. As these move forward they raise the workpiece just enough to clear the turret's supporting fingers and permit free rotation.

After grinding — electrically timed — the turret is swung upward. A latch indexes the turret so that the work rolls onto the unloading rails. The turret continues its upward motion to the loading position and receives the next workpiece.

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Making better products...
to make your products better

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IT'S THE CUTTING EDGES THAT COUNT

Painstaking care by the cutting tool manufacturer in design, processing, and metallurgy makes good cutting edges. With reasonable care by your operator, good cutting edges *stay good* . . . You can rely on National tools to *make good* in stamina and long life.

CALL
YOUR NATIONAL
DISTRIBUTOR

NATIONAL TWIST DRILL AND TOOL COMPANY Rochester, Michigan, U. S. A.

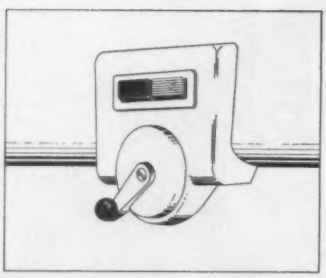
Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles

TWIST DRILLS • REAMERS • COUNTERBORES • MILLING CUTTERS • END MILLS • HOBS • CARBIDE TIPPED AND SPECIAL TOOLS

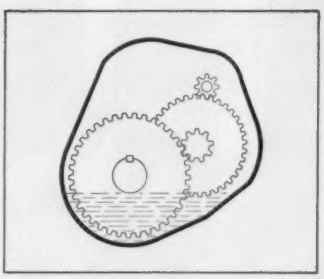
2 New CINCINNATI PRESS BRAKES

THIRTY TON - - - - 2-30 SERIES
FIFTY TON - - - - 3-50 SERIES

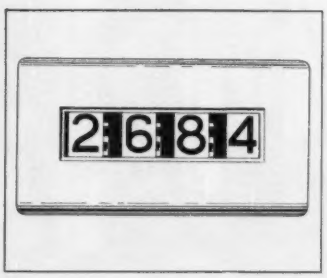
COMPETITIVELY PRICED



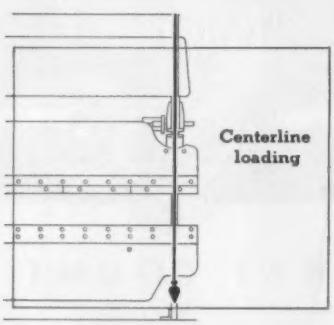
Front controlled, variable speed drive, 20 to 50 strokes per minute.



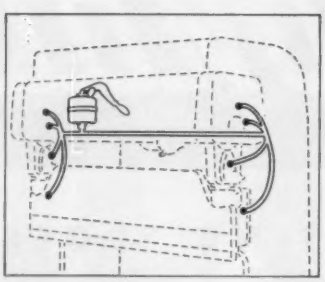
Completely enclosed transmission, running in oil.



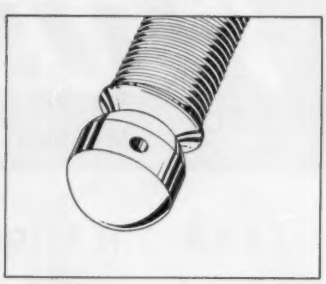
Two micrometer indicators, one at each end of the ram—easy to read and accurately record the amount of adjustment and tilt.



Centerline loading prevents weaving of the housings and insures accurate bends.



Centralized pressure lubrication system.



Ball end on the ram adjusting screws permits tapering of the ram for fade-out work.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

2-30 SERIES

This new 2-30 Series Cincinnati All Steel Press Brake has a capacity of 14 gauge x 6′ mild steel.

Look at these unusual standard features:

2½″ stroke—12″ shut height—9″ throat.

Distance between housings 5′-2″—overall die surface, 6′-0″.

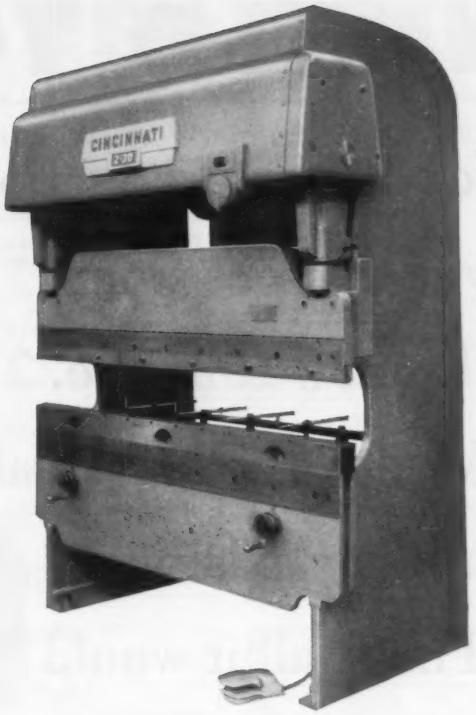
Front controlled, variable speed drive, 20 to 50 SPM. 4″ manual ram adjustment including ram tapering adjustment for fade-out work (power adjustment available as extra feature).

Bronze swivel end-guide bearing for accurate endwise alignment, even when tilting ram.

Brushless electro-magnetic brake and clutch.

Deep bed and ram, planed and drilled for 5¾″ angles.

Micrometer indicators on both ends of ram for fast, accurate setting.



3-50 SERIES

These new 3-50 Series Cincinnati All Steel Press Brakes are built in two lengths and have a capacity of 10 gauge x 6′ mild steel. Investigate these unusual standard features: 3″ stroke—12″ shut height—12″ throat—distance between housings 6′-6″ or 10′-6″—overall die surface 8′-0″ or 12′-0″—front controlled, variable speed drive, 20 to 50 SPM.

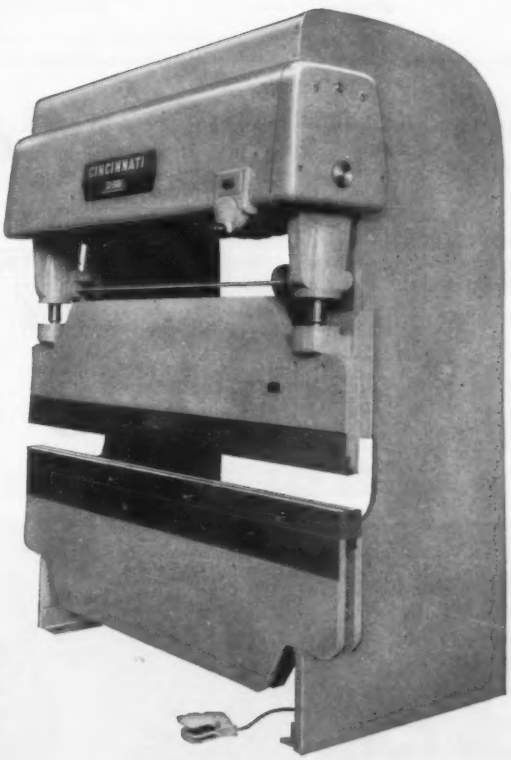
5″ motorized ram adjustment, including ram motor and control, complete with ram tapering adjustment for fade-out work.

Bronze swivel end-guide bearing for accurate endwise alignment, even when tilting ram.

Brushless electro-magnetic brake and clutch.

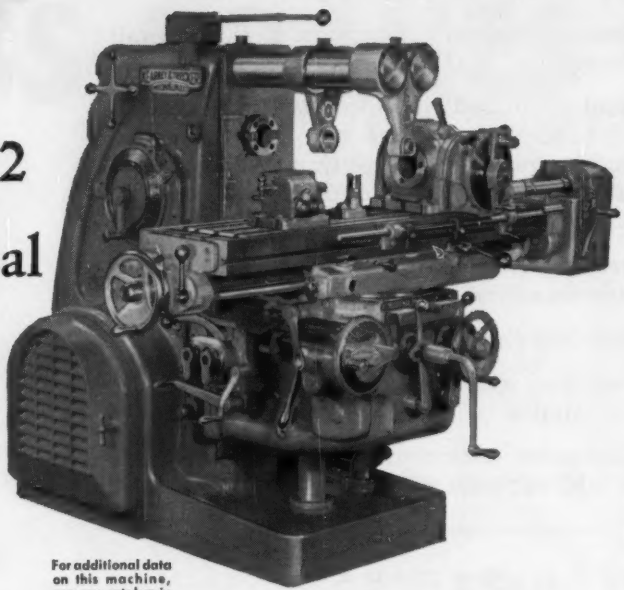
Deep bed and ram, planed and drilled for 5¾″ angles.

Micrometer indicators on both ends of ram for fast, accurate setting.



WOULD YOU SPEND

for all the production you can get from this new 10hp No. 2 Model CK universal milling machine? That's all it would cost you under...



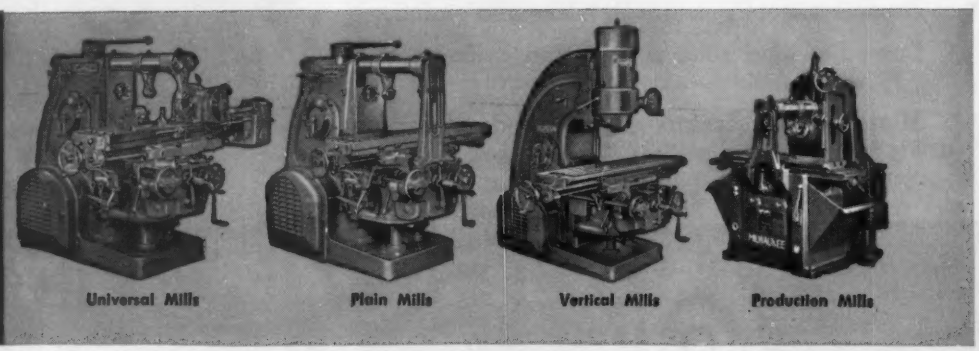
For additional data on this machine, see our catalog in Sweet's.

Kearney & Trecker's

TOOL-LEASE

PROGRAM

Kearney & Trecker manufactures a complete line of more than 250 standard knee and bed type milling machines and precision boring machines.

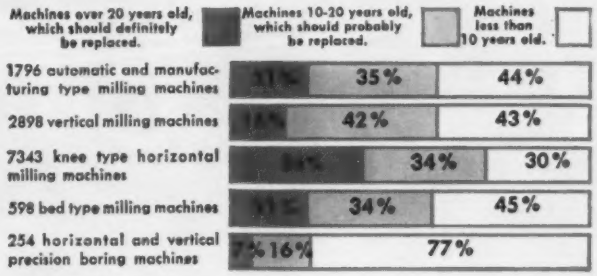


Universal Mills | Plain Mills | Vertical Mills | Production Mills

47½ CENTS PER HOUR

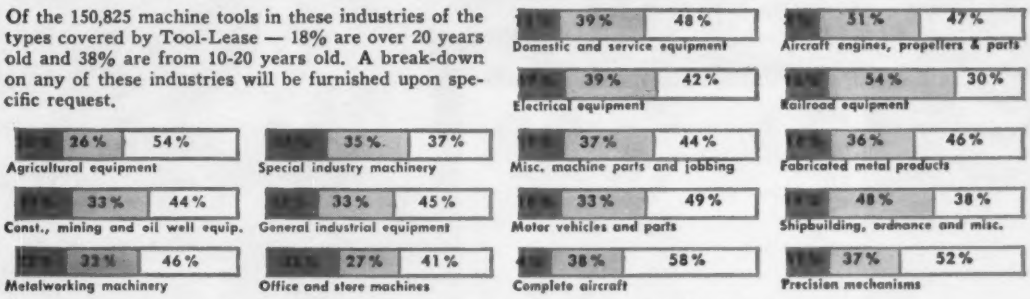
LET'S LOOK AT THE OBSOLESCENCE PICTURE IN THE SPECIAL INDUSTRY MACHINERY FIELD

Includes machines for food-products, textile, woodworking, paper industries, printing, glass-making, cement-making, incandescent lamp-making; paint-making, rubber-working, tobacco-products, shoe-making, and stone-working; smelting and refining equipment. Of the total 12,889 machines in use today which can be replaced by Tool-Lease equipment — 28% are over 20 years old, over 36% are 10 to 20 years old!



HERE'S THE OVERALL PICTURE IN THE ABOVE AND 15 OTHER BASIC INDUSTRIES

Of the 150,825 machine tools in these industries of the types covered by Tool-Lease — 18% are over 20 years old and 38% are from 10-20 years old. A break-down on any of these industries will be furnished upon specific request.



Figures adapted from 1953 American Machinist survey of metalworking industry

HERE'S another popular knee-type universal milling machine, packed with outstanding design and operating features. It's available for your immediate needs under Kearney & Trecker's Tool-Lease program.

Under Tool-Lease Plan "A," one of three seven-year lease agreements offered by Kearney & Trecker, you make two semi-annual rental payments, totaling 25% of the machine's price during each of the first three years. Actually in dollars and cents, you pay 47½ cents per hour for this new 10 hp No. 2 Model CK universal milling machine. That means a machine installed in your plant and in operation — *literally for pennies an hour!*

What's more, under Tool-Lease, you can rent any of over 250 different types and sizes of standard milling machines or precision boring machines. All are available under three basic plans, with varying options to continue or terminate the lease, or to purchase the equipment. If you require special machinery or heavy-duty CSM bed types, special agreements will be considered.

For complete information on Tool-Lease, see your Kearney & Trecker representative or mail coupon to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

TOOL LEASE
KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS
EQUIPMENT ®

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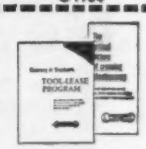
Rotary Head Milling Machines — Automatic Precision Boring Machines

KEARNEY & TRECKER CORP.
6784 W. National Ave., Milwaukee 14, Wis.

Please send me Bulletin TL-10A on Tool-Lease Program and booklet titled "Critical Picture of Creeping Obsolescence."



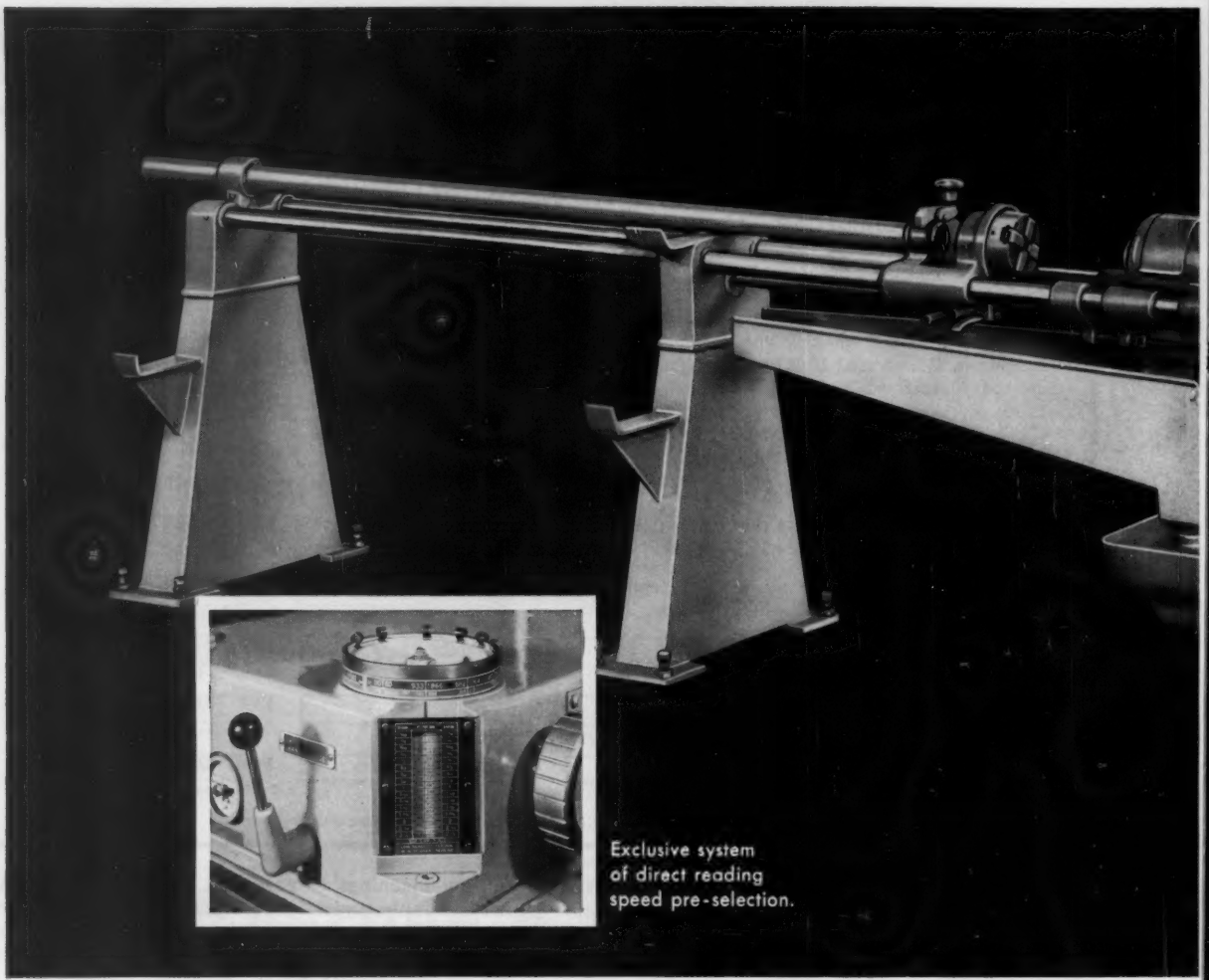
Name.....

Title.....

Company.....

Address.....

City.....Zone.....State.....

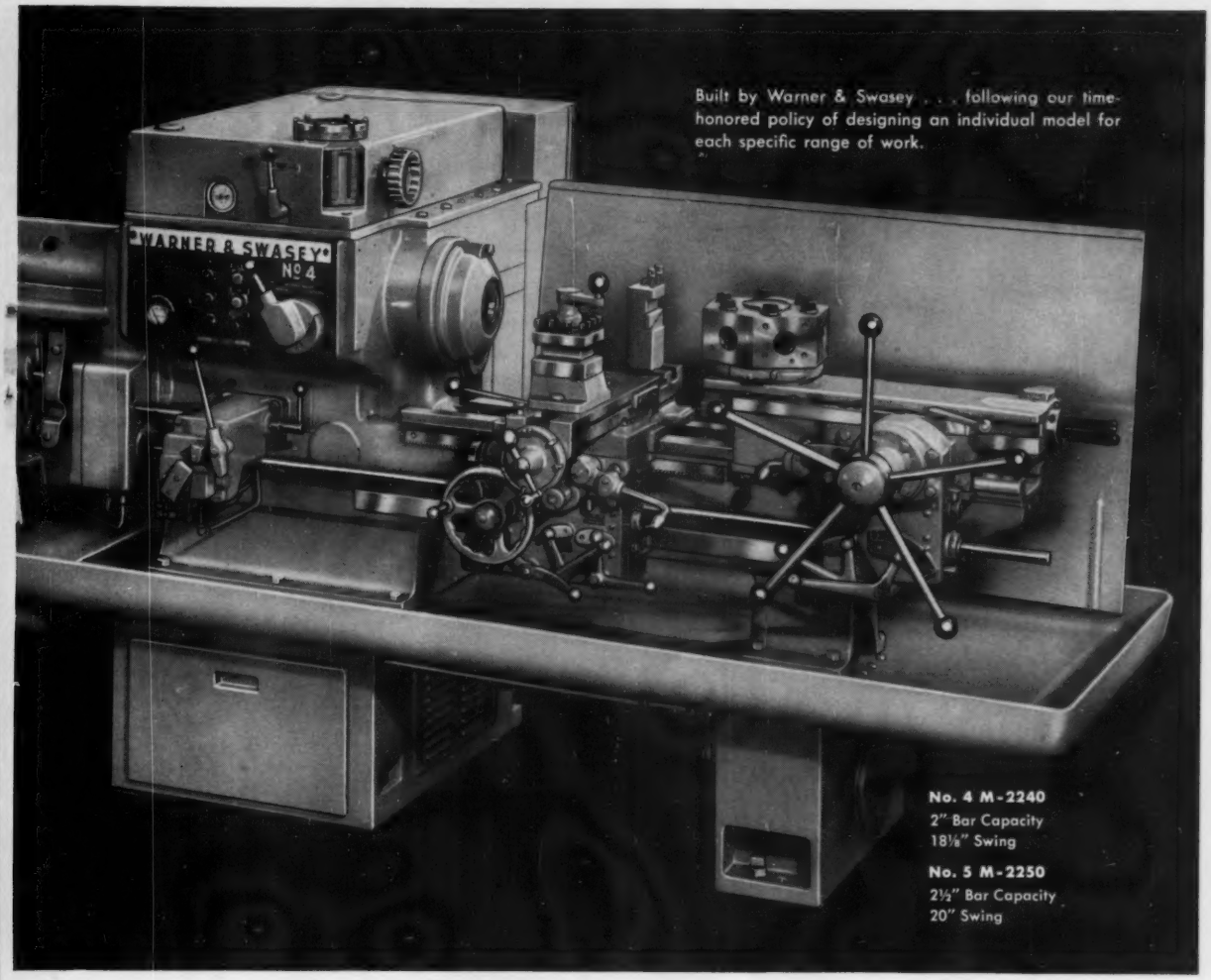


Exclusive system
of direct reading
speed pre-selection.

WARNER & SWASEY

New No. 4 and No. 5 Ram Type Turret Lathes

- Higher Speeds
- Instantaneous speed changes—sliding gears eliminated
- Direct-acting hydraulic clutches—need no adjustment
- Smooth, quiet running, helical high-speed gears
- Short, stubby shafts—anti-friction bearings throughout
- Single lever control for forward, reverse, brake and free spindle
- One lever control for speed



Built by Warner & Swasey . . . following our time-honored policy of designing an individual model for each specific range of work.

No. 4 M-2240
2" Bar Capacity
18⅛" Swing

No. 5 M-2250
2½" Bar Capacity
20" Swing

INTRODUCES...

changes and 6:1 ratio high-low shift

- Two-speed motor provides 24 *unduplicated* speeds, forward and reverse, with a 62.5 to 1 over-all range
- Flange-mounted, direct-drive motors—no belts
- Patented direct-reading speed pre-selector—calibrated in rpm's, surface speed and work diameter
- Rigid, heavy-duty, high speed hydraulic bar feed with adjustable feed-out
- Single lever control for hydraulic collet chuck and bar feed
- Zoned operating controls for effortless machine operation
- One-piece head and bed for greatest possible accuracy
- Larger, separate oil sump provides cooler filtered oil
- Retains Warner & Swasey standard tooling interchangeable with your present models

75TH ANNIVERSARY YEAR
WARNER & SWASEY
Cleveland
PRECISION MACHINERY
1880 — 1955

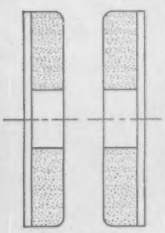
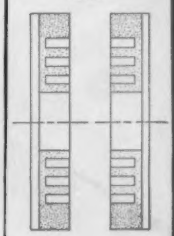
YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

For more information on products advertised, use Inquiry Card, page 239

Disc life increased by 50%

Combination grade Gardner discs cut down time remove more metal per disc

Double disc grinding of small coil springs caused "bell-mouthing" of discs, low production, excessive dressing . . . . Gardner Abrasive Specialist recommended combination grade disc with smooth outer face of harder grade and deep corrugated inner surface of softer grade. The harder outside section resists wear, results in greater stock removal, longer life, fewer dressings.

Former Method single grade discs	Gardner Method combination grade discs
	
Disc Life 228 hrs.	Disc Life 340 hrs.
Dressings 187	Dressings 150
Stock Removed 852 lbs.	Stock Removed 982 lbs.

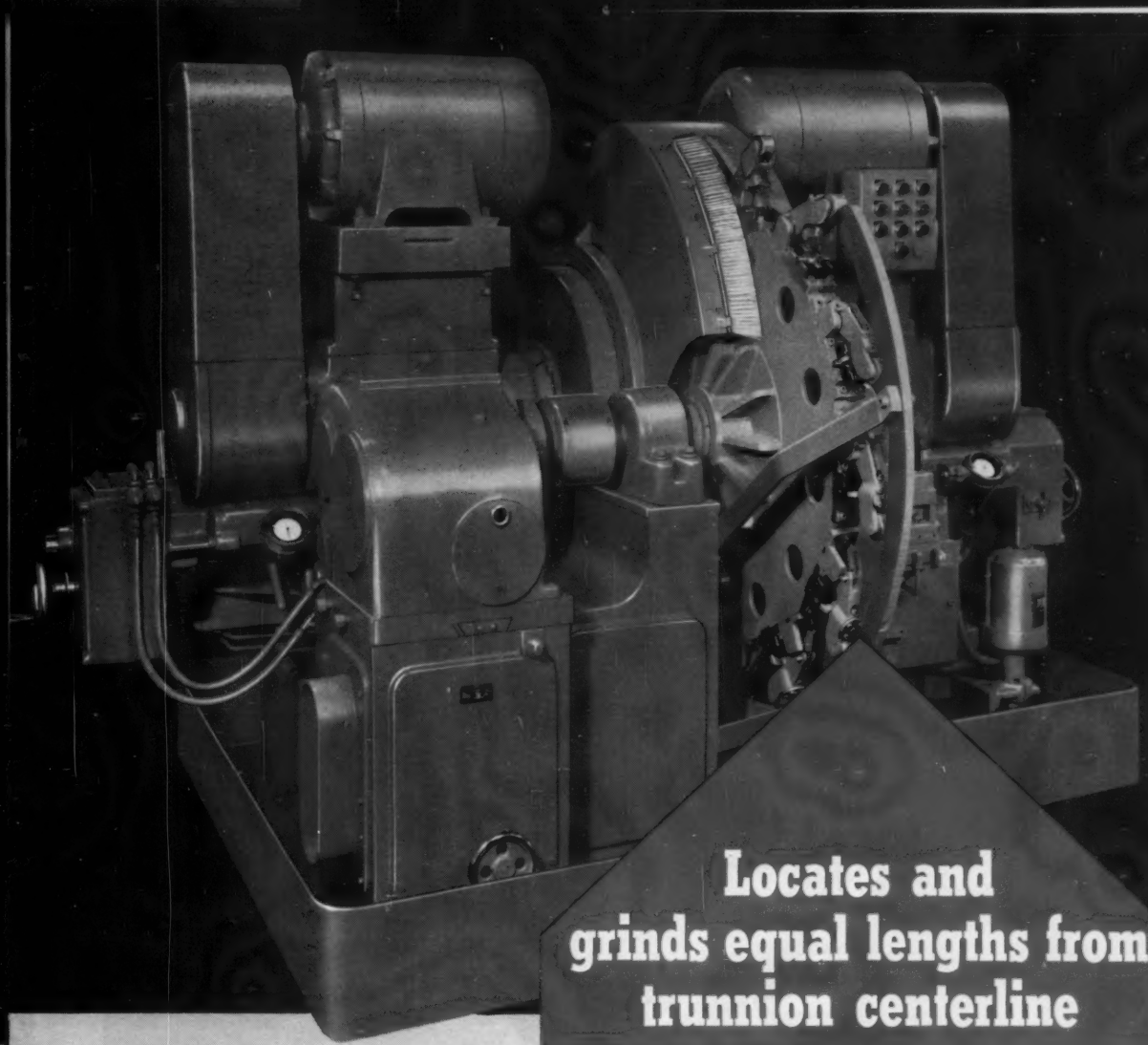
Softer grade with deep corrugations for rapid chip clearance

Harder Grade — Smooth section for shear cut and uniform wear

GARDNER

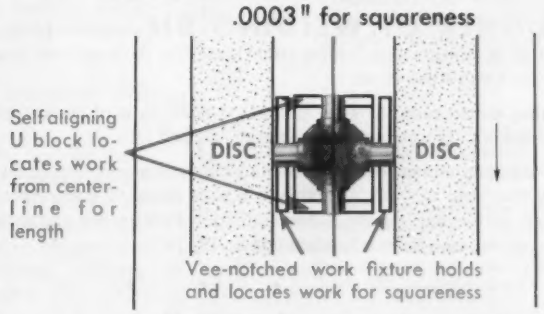
abrasive discs

BELOIT, WISCONSIN



Locates and grinds equal lengths from trunnion centerline

Tolerances: .0005" from centerline
.0003" for squareness


Self aligning U block locates work from centerline for length
DISC
DISC
Vee-notched work fixture holds and locates work for squareness

Production is 300 complete trunnions per hour

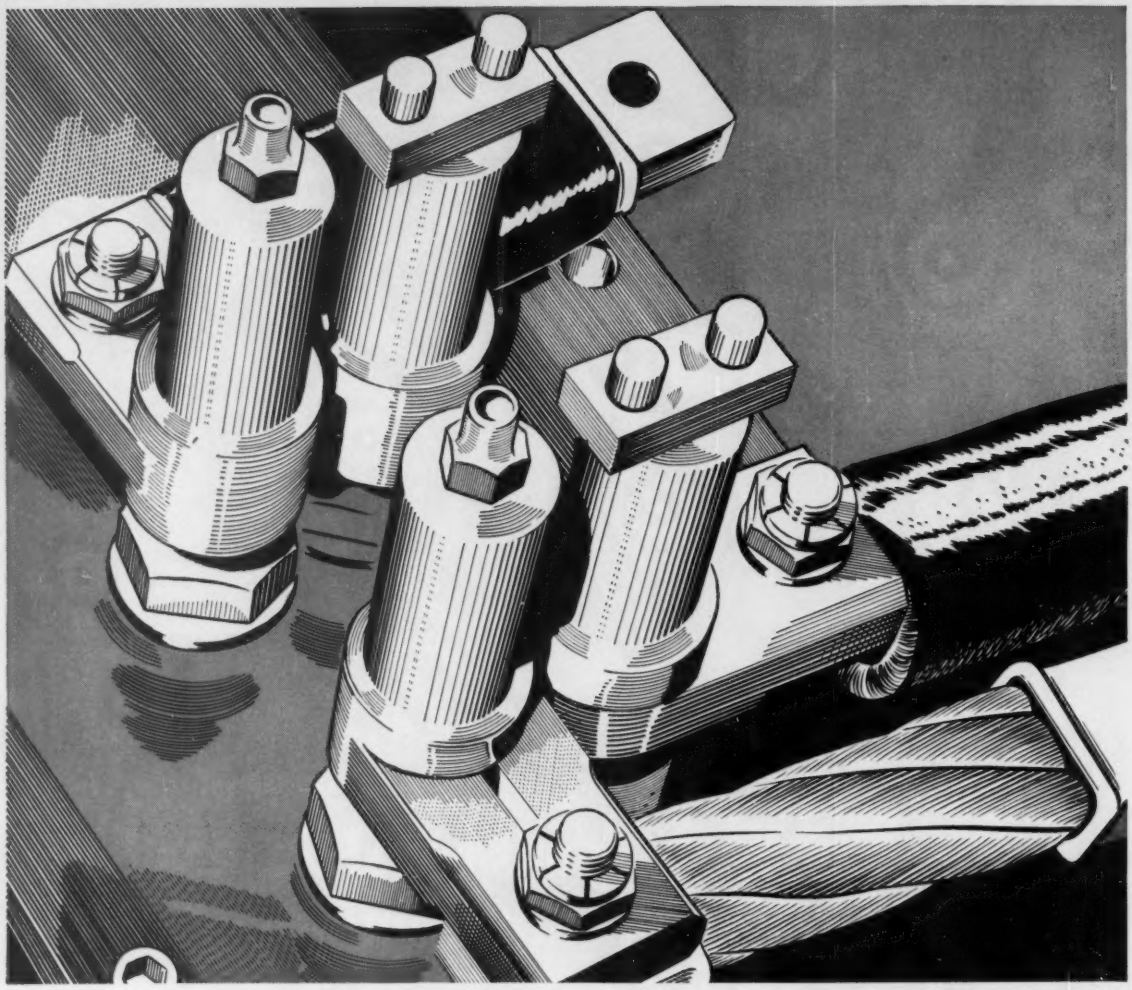
Grinds **TWO** parallel surfaces in **ONE** operation

GARDNER

precision disc grinders

BELOIT, WISCONSIN

FLEXLOC AT WORK



DESIGNER OF WELDING DIE uses one-piece, all-metal thin FLEXLOCS as stop nuts on flexible cable assembly. Although the assembly swivels, FLEXLOCS won't work loose.

Nuts that loosen cause trouble. Contact is poor; flow of current erratic; welding faulty—and faulty welding means inferior finished jobs.

Don't take any chance of nuts loosening on vital assemblies. FLEXLOCS are made to stay put. And they are available in a wide range of sizes, types and material. See your authorized industrial distributor for Bulletin 866 and samples. Or write STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

• • •

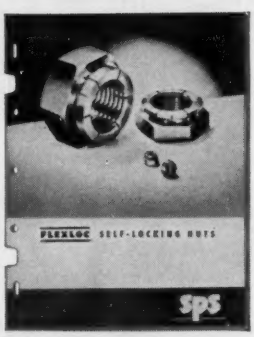
Use FLEXLOCs anywhere safely

ON ROUGH BOLTS. They'll smooth out bolt threads without damaging the threads of the nut.

IN TEMPERATURES TO 550°F in plated nuts and even higher in unplated ones. High temperatures do not affect FLEXLOCS. Nuts with non-metallic inserts fail under such conditions.

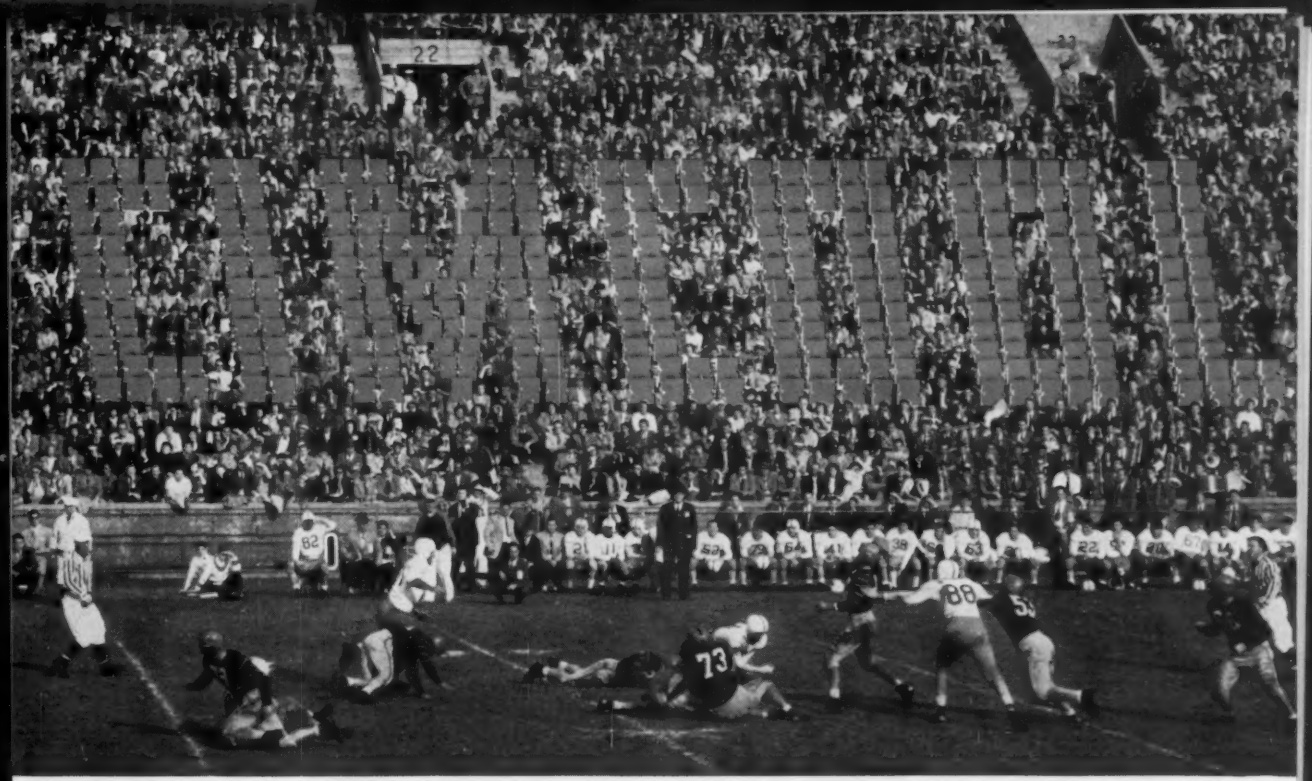
AS STOP OR LOCK NUTS. After at least 1½ threads of a standard bolt are past the top of the nut, the FLEXLOC stays put.

REGARDLESS OF MOISTURE, OIL, DIRT OR GRIT. None of these conditions make any difference to a FLEXLOC, and vibration won't loosen it.



FLEXLOC®
LOCKNUT DIVISION
SPS
JENKINTOWN PENNSYLVANIA

For more information on products advertised, use Inquiry Card, page 239



Why everybody is cheering Cimcool

There are three good reasons why CIMCOOL® Concentrate, the radically new and different cutting fluid, gets three rousing cheers from plants all across the nation:

1. **CIMCOOL LOWERS COSTS** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.
2. **CIMCOOL DOES A BETTER JOB** because of its chemical lubricity. It permits faster speeds and increases tool life, for it combines friction reduction and cooling capacity in a degree never before attained.
3. **CIMCOOL** Concentrate has become, in just a few years, the largest selling chemical cutting fluid in the world.

We know CIMCOOL will score a touchdown with you, and we'll be glad to spell-out the many specific advantages of CIMCOOL Concentrate. We will also provide details on the entire family of CIMCOOL Cutting Fluids. Just contact us and we'll send one of our Cincinnati Milling-trained machinists—without cost or obligation. Wire, write, or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

CIMCOOL CUTTING FLUIDS

CIMCOOL **Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL **Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT **Base Additive** — For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for higher speeds and feeds.

CIMCOOL **Bactericide** — The most effective agent yet developed to overcome rancidity and foul odors.

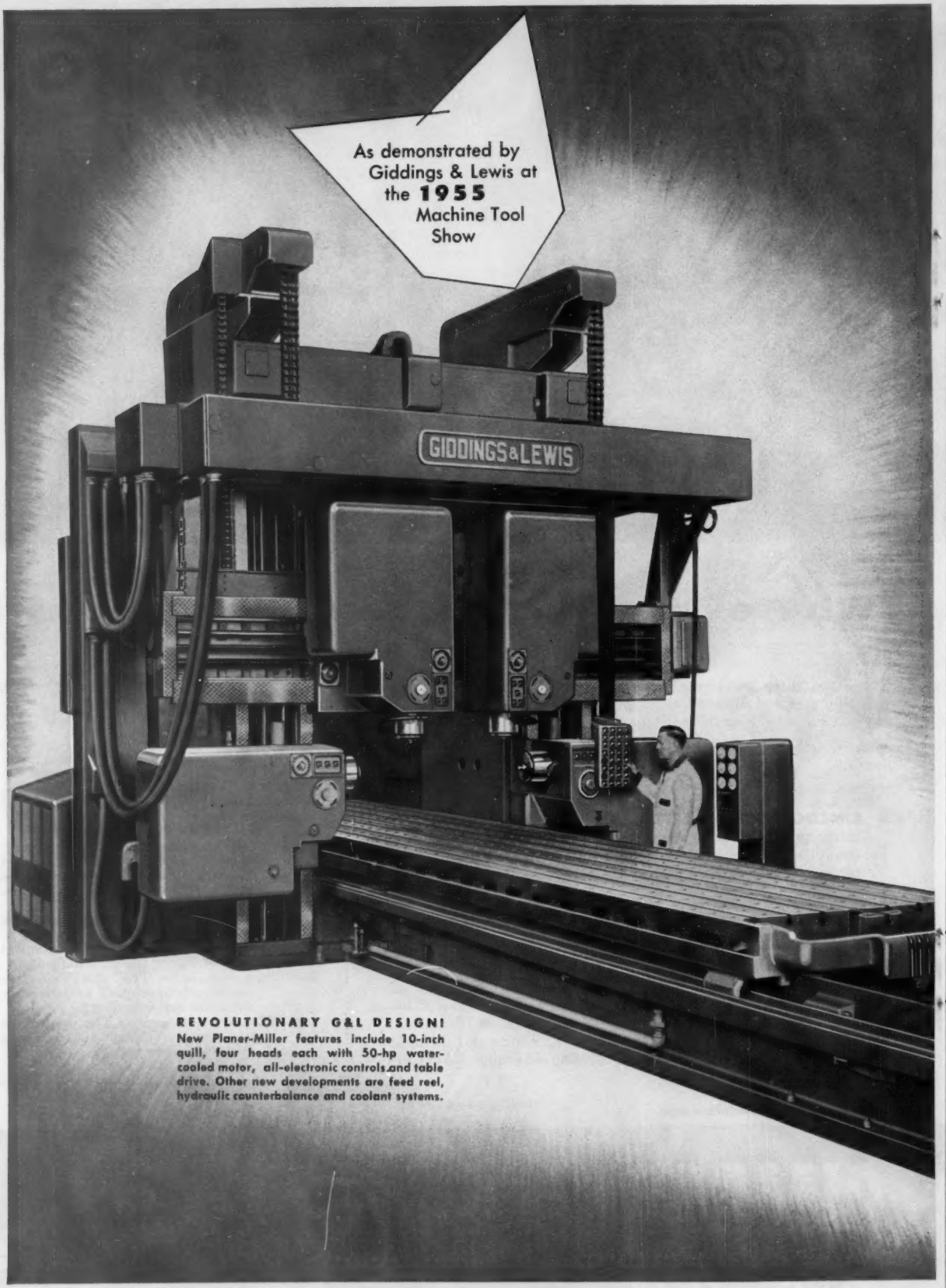
CIMCOOL **Machine Cleaner** — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

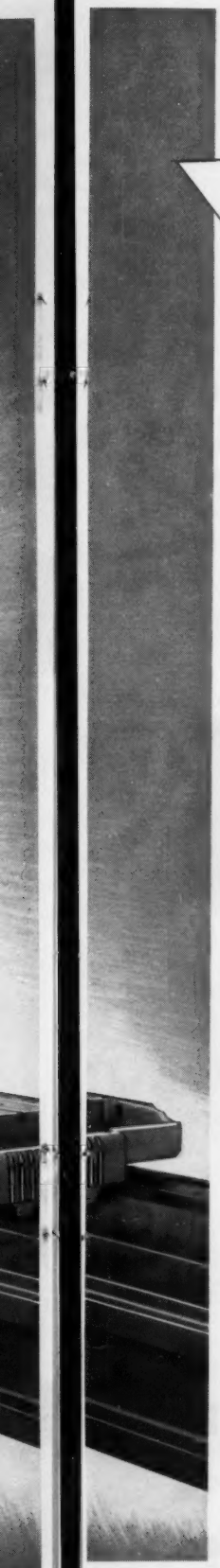
*Trade Mark Reg. U.S. Pat. Off.

CIMCOOL Cutting Fluids

for 100% of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.


As demonstrated by Giddings & Lewis at the 1955 Machine Tool Show
GIDDINGS & LEWIS
REVOLUTIONARY G&L DESIGN!
New Planer-Miller features include 10-inch quill, four heads each with 50-hp water-cooled motor, all-electronic controls and table drive. Other new developments are feed reel, hydraulic counterbalance and coolant systems.



NEW

Cool-headed Goliath...
master of low-cost production

Here's Giddings & Lewis all-new Hypro Planer-Miller... superbly engineered for high-speed, super-precision milling...years ahead in modern machine design

GIDDINGS & LEWIS offers you the world's finest 10-inch quill Hypro Planer-Miller—a 120-ton 72" x 72" x 24' giant of low-cost production. It's available with a wide variety of table and bed lengths and up to 144" width. Every principal machine component is designed to give you the ultimate in precision plane milling at high speeds. Revolutionary design features include:

MILLING HEADS—Each of four heads, powered by a 50-hp, 1800-rpm water-cooled motor, is provided with 24 spindle speeds in fine geometric progression from 9 to 500 rpm. Each head is equipped for "toe-in-or-toe-out" positioning for milling different types of steel alloys . . . or to accomplish special roughing or finishing operations. This feature also offers particular advantages for boring operations.

TABLE DRIVE—Because table drive is designed for practically zero backlash, it permits both climb and conventional milling with equal facility. New heavy-duty jaw clamp securely holds the table in position for cross-milling.

CONTROLS—All auxiliary functions of machine are electronically-controlled from permanent-type panel, and all operating functions from a traveling pendant station. Floor-mounted control station is for set-up purposes. Also, there are calibrating indicating instruments for direct reading of feeds in inches-per-minute and spindle hp consumption. Control is also provided for starting and stopping all service functions complete with indicating lights to show that these services are operating properly. Controls are properly interlocked so that duplicated control functions operate at only one station at a time.

FEED REEL SYSTEM—Giddings & Lewis' new feed reel system encloses all electrical, hydraulic and coolant facilities—usually found as collection of cables and wires around headstocks on conventional machines.

HYDRAULIC COUNTERBALANCE SYSTEM—An exclusive design by G&L, this new development plays an important part in flatness accuracy in milling with rail heads. It reduces to a minimum the wear between rail and headstock saddle. It also reduces appreciably the amount of power necessary to feed the heads and rail.

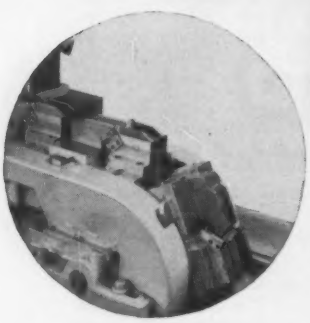
For complete specifications on the Giddings & Lewis new Hypro Planer-Millers, contact your nearest representative, or write—

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty machine tools—Horizontal Boring, Drilling and Milling Machines—table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines; Vertical Boring Mills; Upright and Radial Drilling Machines; and Davis Boring and Cutting Tools.

Lower Cost per piece with Surface Broaching of small parts



■ Holding fixtures are designed for quick, convenient loading, with automatic clamping and unclamping.

■ In many plants where large quantities of duplicate metal parts are being machined, substantial savings are being made through the adoption of surface broaching. Production is exceptionally high, close tolerances are maintained, and tool maintenance costs are much lower than with ordinary methods. Foote-Burt engineers, pioneers in this advanced machining method, have had a wide experience in applying surface broaching in many fields.

THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building

☆engineered for production

FOOTBURT

PIONEERS IN SURFACE BROACHING

Feeling M-i-g-h-t-y Low?

IF GRINDING WHEEL PROBLEMS HAVE YOU DOWN IN THE DUMPS, DON'T MONKEY AROUND. Switch to CINCINNATI (PD) WHEELS. For *now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION—a remarkable achievement in precision manufacturing and quality control that *can save you money . . . and increase your production.*

You'll start every day with a big smile and a spring in your step when CINCINNATI (PD) WHEELS are on the job. For through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

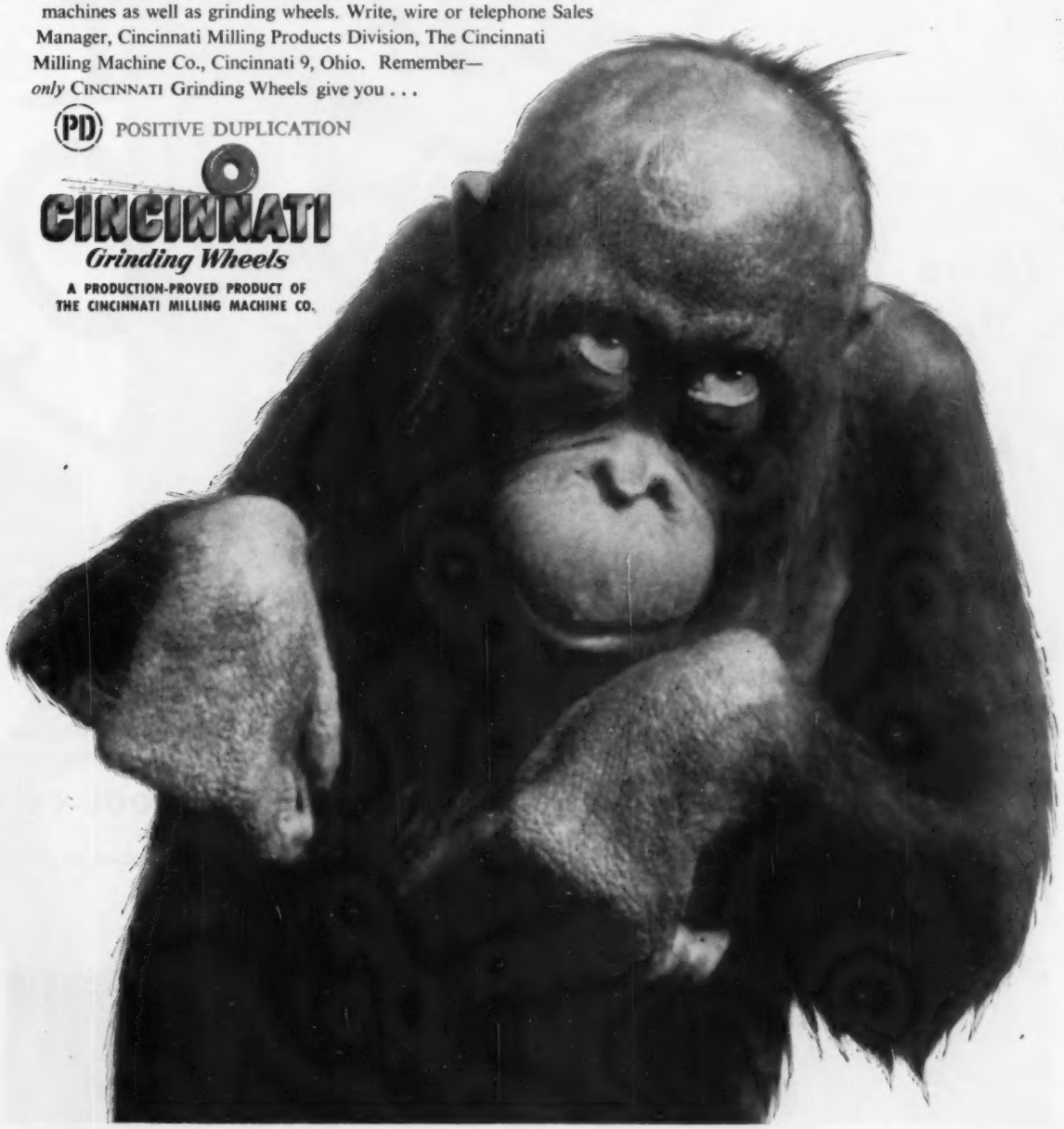
Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

So, let us help you see the bright side of life once more. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. Remember—*only* CINCINNATI Grinding Wheels give you . . .

(PD) POSITIVE DUPLICATION

CINCINNATI *Grinding Wheels*

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.



ARMSTRONG

More Tools Per Man for More Profit

Even when labor was cheap and tools were costly, it was the best tooled shops that prospered. Now, with wages higher and the work days shorter, it becomes imperative that every worker be supplied with every tool that will increase his hourly production.

See that each lathe, planer and shaper operator has the correct ARMSTRONG TOOL HOLDERS for each operation he performs. Equip each machine with its full complement of ARMSTRONG Setting-up Tools. Use better balanced, handier ARMSTRONG WRENCHES on machines and assembly lines. Specify ARMSTRONG Drop Forged "C" Clamps and Lathe Dogs . . . Today, only quality tools can be truly economical.

Write for the ARMSTRONG Catalog. It has page after page of production-increasing, cost-cutting tools.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5213 W. ARMSTRONG AVENUE CHICAGO 30, U.S.A.

New York and San Francisco

Armstrong Tools are Stocked by Industrial Distributors

For more information on products advertised, use Inquiry Card, page 239

World Sawing Records!

Ask to see the "World Records" Album of samples of DoALL Power Sawing.

Faster Sawing than Ever Before...

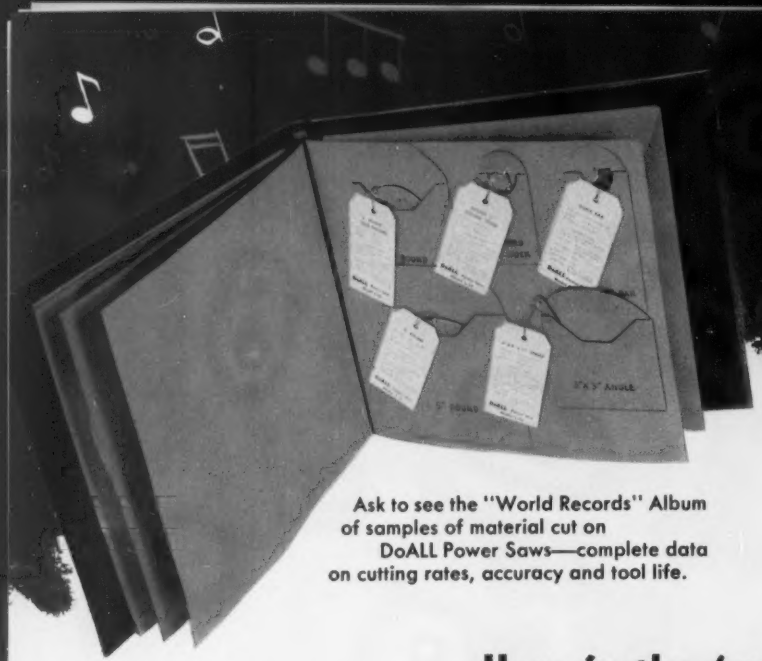
The new DoALL Automatic Power Saw is faster than hack saws . . . faster than any other band machine . . . at least 100% faster than any cut-off saw of comparable size and price in the world! Cutting rates up to 15 square inches per minute on ferrous metals. Saves time, labor and *material*, too. Cuts cut-off costs 50% and more.

Turn the page for facts, figures and the answers to your questions.

DoALL

The DoALL Company
Des Plaines, Illinois

WORLD That Sings



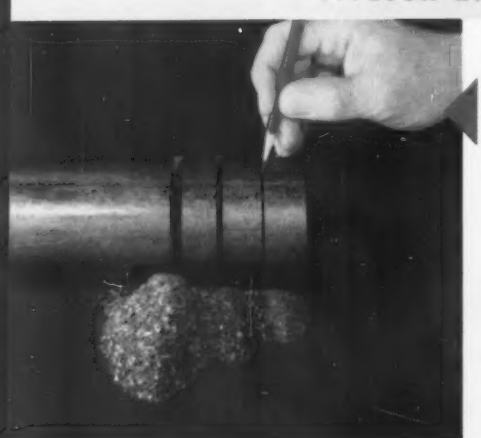
Ask to see the "World Records" Album of samples of material cut on DoALL Power Saws—complete data on cutting rates, accuracy and tool life.

...Here is the (musical) "score"...

a superior melody of cut-off saw performance

MATERIAL	AREA/CUT (SQ. IN.)	BRINELL HARDNESS	SAWING TIME/CUT	SQ. INCH PER MIN.	TOOL LIFE
2" DIA. C-1018	3.14	150	20 sec.	9.42	3000 pieces
6" DIA. C-1018	28.27	152	2.83 min.	10	354 pieces
3½" x 3½" C-1045	12	165	1.2 min.	10	600 pieces
8" x 8" "H" STRUCTURAL STEEL	10.140	—	1.27 min.	8	500 pieces
5" DIA. B-1112	19.63	125	1.28 min.	15	700 pieces
1½" x 2½" REX AA	3.75	212	1.25 min.	3	723 pieces
4⅛" DIA. M-2	12.75	210	4.25 min.	3	206 pieces
1½" x 10" AISI 1095	15	200	2.14 min.	7	220 pieces
5" DIA. 4150-FM	19.63	196	1.97 min.	9.9	300 pieces
6" DIA. TITANIUM TYPE 140-A	28.27	310	35.46 min.	.832	20 pieces
1.5" x 1.5" 52100	2.25	187	.53 min.	4.6	1100 pieces
5" x ¾" WALL CFS1015 TUBING	10	179	1.16 min.	8.6	600 pieces

...Look at these material savings...



Left—Compare the ⅛" kerf of a DoALL Demon continuous-cutting blade with that of a ⅛" hack saw blade or ¼" cold saw blade.

Every 9th Piece a Dividend!

Right—The extra ½" thick blank would have been wasted by a heavy hack saw blade—important cost item with expensive materials.

RECORD CUT-OFF "MUSIC" of Lower Production Costs!

NEW DoALL *AUTOMATIC* POWER SAW
...a *Symphony* of speed and precision

18,000 CHIPS PER MINUTE—that's the output of a 6-pitch DoALL band tool running 250 FPM—clean cut chips produced at a rate possible only with a *continuous-cutting* saw band. The table on the left hand page shows what this means in terms of cut-off production.

HI-FI ACCURACY—.002" accuracy per inch of work thickness in automatic sawing. The slice of 12" high-chrome, high-carbon tool steel round in the "World Records" Album varies no more than .024" in thickness from top to bottom. 50 to 60% of the cuts from a 6" titanium round were accurate in thickness within .005" —none of the 28 cuts in the test run deviated more than .010". No hack saw can cut more accurately.

CONSTANT FEED PRESSURE—the operator sets feed as recommended on the Job Selector and automatic regulation maintains uniform pressure at all points throughout the cut.

FACTORY-SET BLADE TENSION—another DoALL feature that *automatically* keeps blade at correct tautness for maximum production without reliance upon the operator.

INFINITELY VARIABLE SPEED—from 60 to 350 FPM, together with the feed control provides the maximum cutting rate for any job.

DEMON HIGH-SPEED STEEL BLADE—the teeth do not lose hardness even at red heat temperatures, permitting heavy feeds, high speeds and lower cost cutting.

FULLY AUTOMATIC—standard stock indexing adjustable to 24"; greater length available.

Turn the page for the FACTS about Demon High-Speed Steel blade costs . . .

New DoALL Demon High-Speed Steel Blades retain their hardness at temperatures up to 1100° F., permitting cutting rates many, many times in excess of any previous saw band.

Records of DoALL Demon® —High-Speed Steel Blade

In terms of either time or material savings, DoALL Demon Blades on a DoALL Power Saw are the lowest cost blades you can buy. With this team you'll save 4 hours or more per 8-hour day over a comparably priced hack saw. If you paid only $1.00 per hour for labor, the time saving alone would pay the full price of every Demon Blade you used!

If you were cutting mild steel costing as little as 13¢ per lb., the difference between the $\frac{1}{16}$" Demon Blade thickness and a $\frac{1}{8}$" hack saw blade thickness would result in material savings that alone would pay the full price of every Demon Blade used.

Viewed from any angle you will cut your cut-off costs 50% or more with a DoALL Power Saw and Demon Blade. Ask for complete information today.

See it and believe it! *Ask for a free demonstration* at your plant without obligation. You will be amazed at how the new DoALL Automatic Power Saw with Demon High-Speed Steel Blade slices through metal—just watch your watch while it performs. You'll see it spell out big *time* and *cost* savings every inch of the way. Call your local DoALL Store for a demonstration at your convenience, or write The DoALL Company, Des Plaines, Ill.

Available in welded lengths from your local DoALL Store — 1" wide, 2 to 10 pitch.

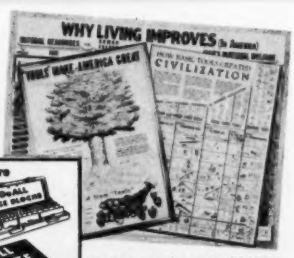
DoALL

The DoALL Company Des Plaines, Illinois

Friendly DoAll Stores . . . (in 37 cities)

Personalized Service . . . Complete Stocks . . . Local Delivery

Call Your DoALL Service-Store
DoALL SAW BANDS
DoALL GRANITE PLATES
Machine Tools • Cutting Tools • Measuring Instruments
Shop Supplies • In Stock
The DoALL Company, Des Plaines, Ill.



EDUCATIONAL STUDY WALL CHARTS

Economic Principles

$1.00 each postpaid

Lower quantity prices

ETTCO-EMRICK
Lead Screw Tapping Equipment

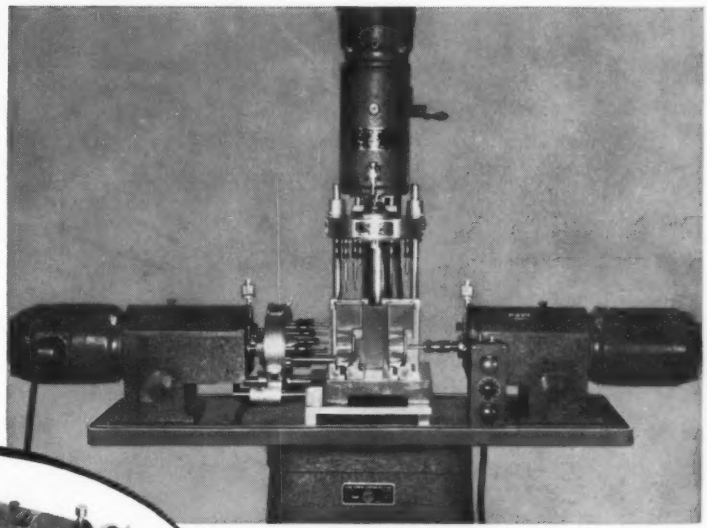
ALL-ELECTRIC operation and control... for the fastest, most accurate tapping yet!

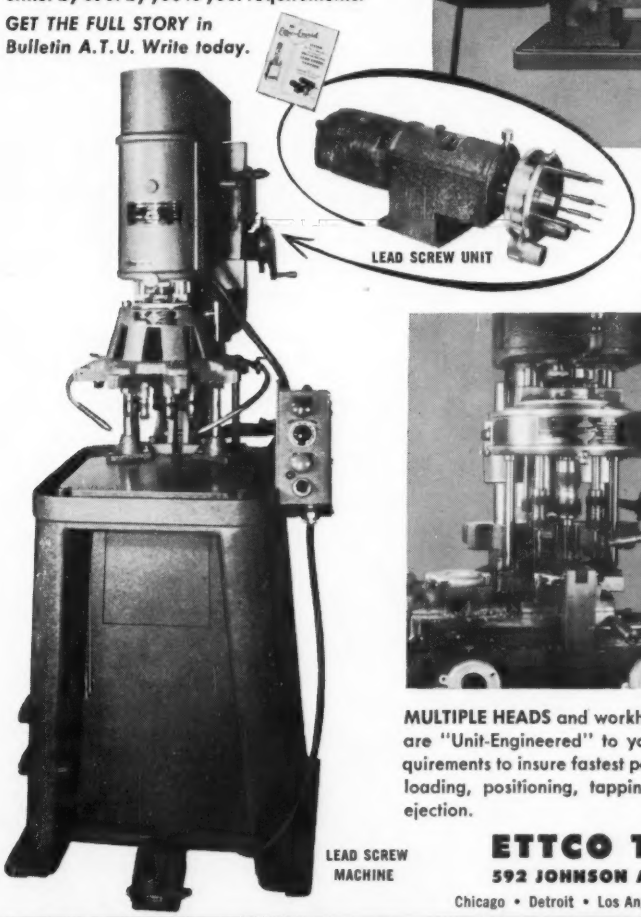
No reversing motor needed— electro-magnetic clutches do the work

This exclusive feature provides a speed, sensitivity and precision unequalled by any other tapping method or device. It eliminates the need for a reversing motor, cams, air and hydraulic systems.

You get all these advantages in both single and multiple spindle operation because Ettco-Emrick all-electric Lead Screw Tapping Equipment can be used as single spindle units or in combination with Ettco-Emrick Multiple Spindle Heads. The equipment can be furnished: (1) as individual units; (2) as standard upright machines; or (3) as special machines built either by us or by you to your requirements.

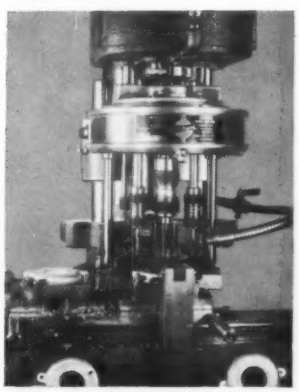
GET THE FULL STORY in Bulletin A.T.U. Write today.



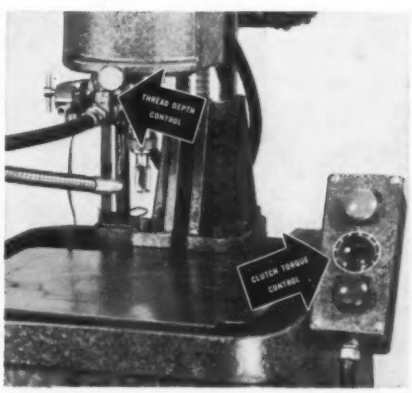


LEAD SCREW MACHINE

BASIC LEAD SCREW UNITS when combined with standard Lead Screw Machines and Ettco-Emrick Multiple Heads and workholding fixtures give the advantages of high speed, precision "specials." Standardized Ettco components make this tooling practical and inexpensive.



MULTIPLE HEADS and workholders are "Unit-Engineered" to your requirements to insure fastest possible loading, positioning, tapping and ejection.



Clutch torque can be regulated to meet tapping conditions. Thread depth can be controlled to within ¼ turn of tap.

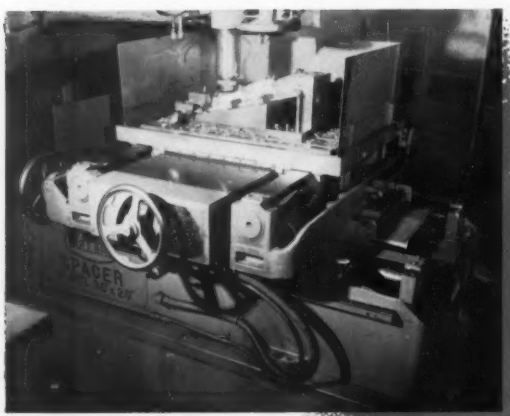
ETTCO TOOL CO., INC.
592 JOHNSON AVE. • BROOKLYN 37, N. Y.
Chicago • Detroit • Los Angeles — Distributors throughout U. S. and Canada

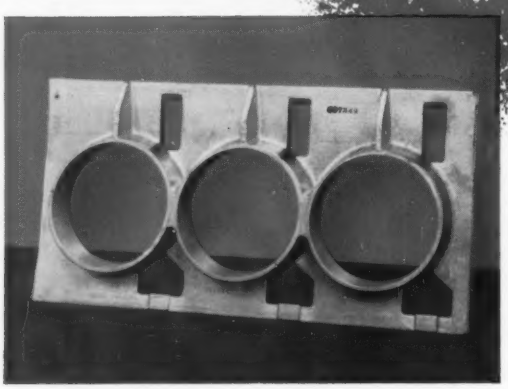
Ettco-Emrick

TAPPING ATTACHMENTS • MULTIPLE HEADS • TAPPING MACHINES • INDEXING FIXTURES • TAP AND DRILL CHUCKS

For more information on products advertised, use Inquiry Card, page 239

Extreme Accuracy with a BULLARD Spacer Table





Builders of the P2V3 Neptune Anti-Submarine Aircraft, The Lockheed Aircraft Corporation, have this to say concerning their experience with the Bullard Spacer Table employed to machine a cast aluminum support for the Sonobuoy Chute.

"Before we used the Bullard Spacer Table, we put this kind of work (boring 3 holes of 5.250 diameter) either into a jig or on a horizontal boring machine. The reason we put this piece on the Bullard Spacer Table is that the holes are too large for a drill jig and dial spacing for hole location on the horizontal was time consuming. What is more remarkable about the Spacer Table is the fact that it can handle such large diameters with the greatest accuracy. Another advantage of the Bullard Spacer Table is the simplified tooling. All we need is a simple holding fixture. The spacing is done automatically by the Spacer Table".

these advantages can be applied to your machining problems. Ask your nearest Bullard Sales Engineer or Distributor or write us for Spacer Catalog

THE BULLARD COMPANY

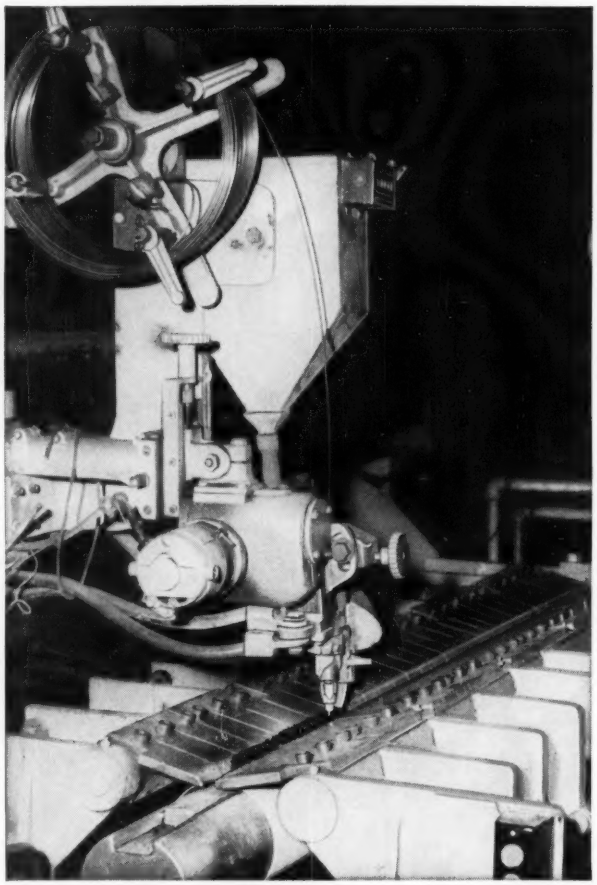
BRIDGEPORT 2, CONNECTICUT

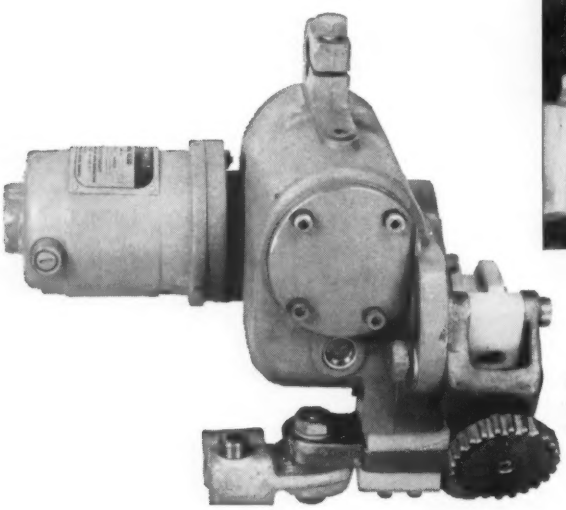
CUT *maintenance costs on tough welding jobs with the* New UNIONMELT DSH *welding head*

Trade-Mark

Here's the low cost, submerged melt welding head that saves maintenance costs on tough welding operations. The new UNIONMELT DSH head combines the flexibility of the lighter units with the ruggedness needed in heavy-duty welding machines. Large, sturdy gears and bearings give long, trouble-free service though work may involve frequent starts and stops and feeding heavy electrode wire. Simple controls and mounting arrangements make the DSH head easy to operate and maintain.

UNIONMELT welding joins thin metals at speeds up to 200 in. per minute or makes one-pass welds with a 3-inch penetration if desired. If you have a production job in your plant that requires high-quality welds made at high speeds, ask your nearest LINDE Office today for more information about UNIONMELT welding. A LINDE Engineer will be glad to help you plan your UNIONMELT installation for high-speed, production welding.





With the new UNIONMELT DSH head now available in five output speeds, you can select the best unit you need for making high-quality low-cost welds at the highest welding speeds.

Linde Air Products Company

A Division of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, N. Y.

Offices in Other Principal Cities

In Canada: LINDE AIR PRODUCTS COMPANY

Division of Union Carbide Canada Limited, Toronto

(formerly Dominion Oxygen Company)

The terms "Linde" and "Unionmelt" are registered trade-marks of Union Carbide and Carbon Corporation.

Linde

Trade-Mark

For more information on products advertised, use Inquiry Card, page 239

TAPS *and* GAGES *by* CARD

Now, Card brings you a select line of gages along with renowned Card taps. You can specify and use both with complete confidence, knowing that whatever the job demands, you'll get top performance. We assure you that the new line of gages boasts the same quality of manufacture that has made Card taps famous over the past 81 years.

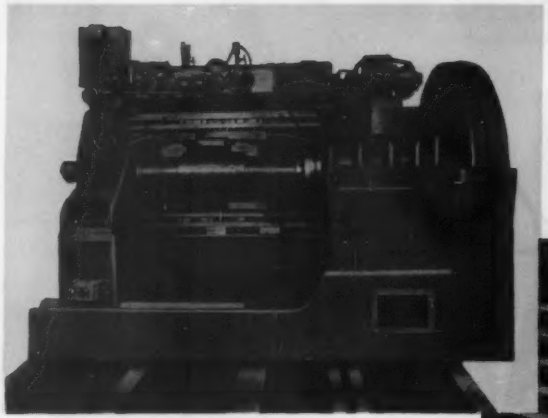
Contact your local Card Distributor for prompt deliveries and helpful service.

The CARD Quality

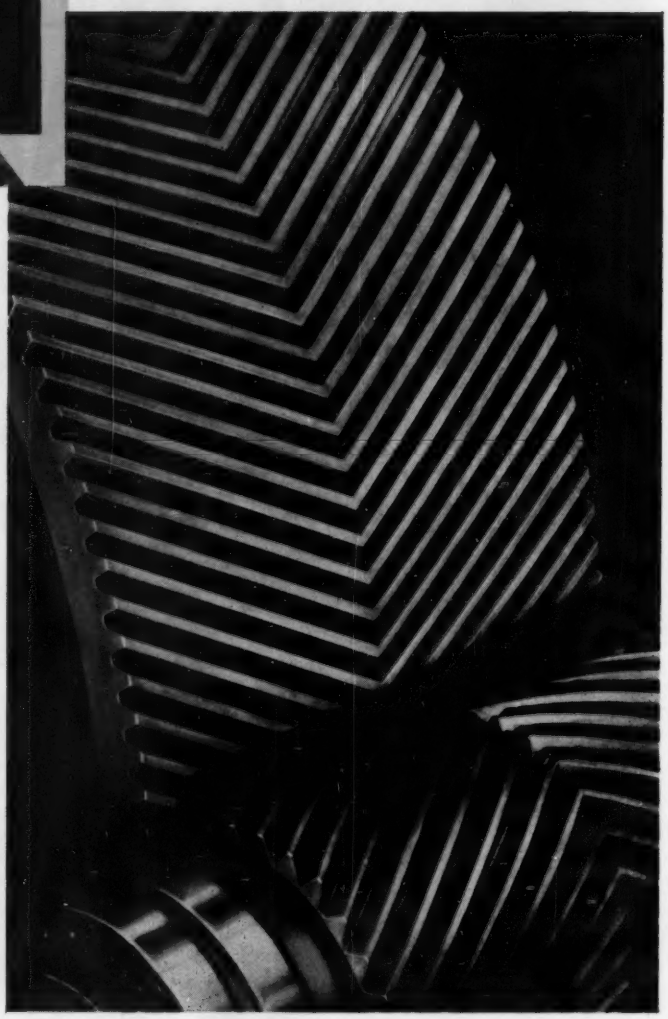
S. W. CARD MANUFACTURING CO. **MANSFIELD, MASS.**

Division of Union Twist Drill Co. **TAPS · DIES · SCREW PLATES · GAGES**

How to cut...



harder working gears



The Farrel-Sykes "Twin-Head" gear generator generates the two helices of a continuous-tooth herringbone gear simultaneously — without a center groove. Because there is no groove in the center, the entire face width of the gear performs useful work, providing extra strength and greater load-carrying capacity.

At the same time, the generator gives the gears extremely accurate tooth spacing, profile and helix angle. This pays off in smooth, quiet gear performance and prolonged gear life.

The "Twin-Head" generator also gives you versatility, high production and convenient operation. It makes fast, simple work of cutting every type of herringbone gear, single helical and spur gears, two members of a cluster gear at the same time, and other toothed and cylindrical forms.

Write for details of this accurate, versatile gear machine.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

Sales Offices: Ansonia, Buffalo, New York, Cambridge (Mass.), Akron, Cleveland, Chicago, Los Angeles, Houston.

FB-1006

Farrel-Birmingham®

Immediate savings in production costs are made by switching from the old shoulder machining method to Reliance Snap Rings. The old method made it necessary to machine the entire length of an oversized shaft to form a shoulder. Now it can be done simply and easily by milling a groove and snapping in a Reliance Ring on a standard size shaft. Machining time, money and material are saved at no sacrifice in product quality or performance. Wherever you are mounting gears or bearings, consider the cost reducing features of Reliance Snap Bearing, Lock and Retainer Rings. You can't lose anything and may save a lot. Write for free Engineering Bulletin 4K3.

RELIANCE DIVISION EATON® MANUFACTURING COMPANY

Springtites & Sems · Snap & Retaining Rings · Special Steels · Spring Lock Washers · Mon-Fas-Nar

507 Charles Ave., Massillon, Ohio

SALES OFFICES: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

For more information on products advertised, use Inquiry Card, page 239

STANDARD
technical service clicks at Argus Camera

Personnel at Argus Camera Company were having trouble with the grinding of thread plug gauges. Grinding oils used failed to hold the required accuracy. They called in L. H. Walker, Standard Oil industrial lubrication specialist. He recommended Standard's SUPERLA Thread Grinding Oil A, and Argus began using it. That was four years ago. What happened? SUPERLA Thread Grinding Oil has helped Argus grind thread plug gauges with such accuracy, so consistently, rejects are virtually eliminated.

Small job? Yes. Small volume of oil used? Yes. But the results are big business to Argus Camera. That makes it important to Standard Oil. It is another demonstration of what this unbeatable combination can do when put to work:

1. **Standard lubrication specialists capable of giving technical help.**
2. **Top quality products *that deliver results required.***

Put this combination to work in your plant. In the Midwest there is a lubrication specialist in your nearby Standard Oil office ready to help you. Call him. Or contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

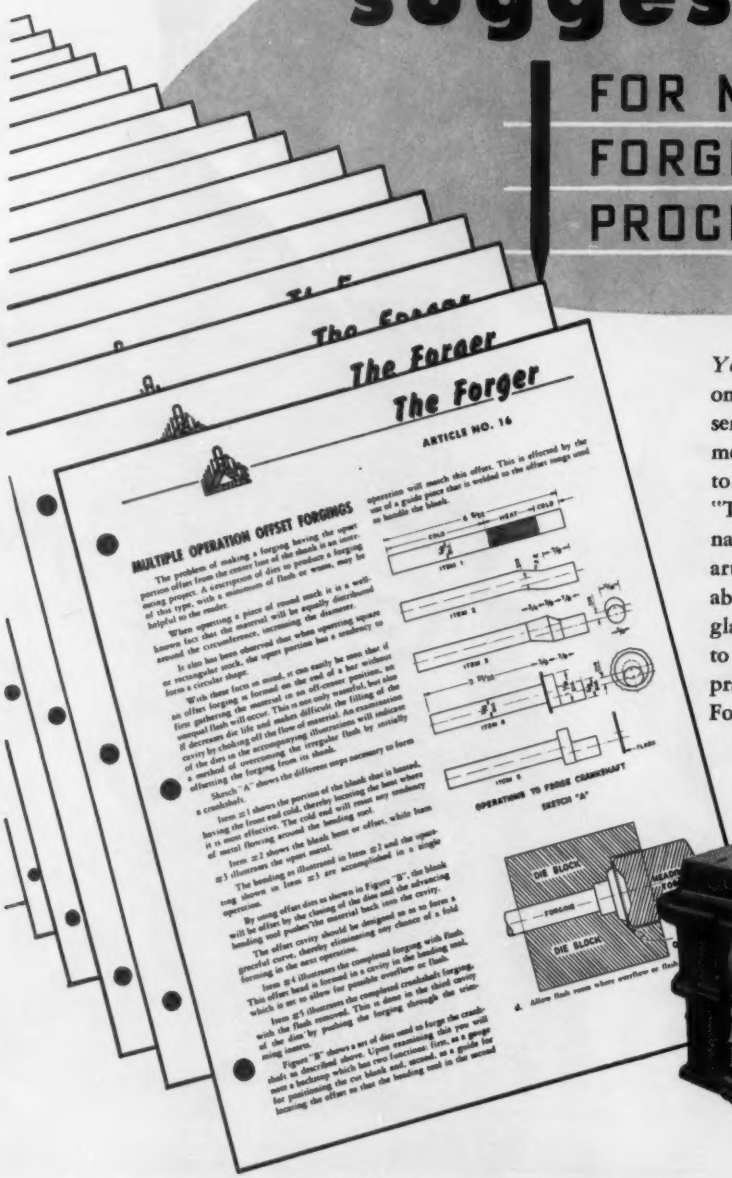
STANDARD

STANDARD OIL COMPANY
(Indiana)

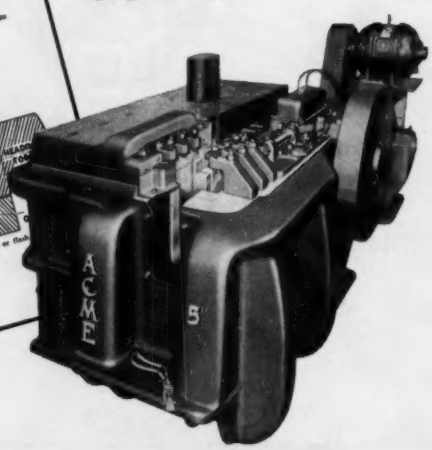
Omer L. Parks (left), tool and gauge grinder for Argus Camera, inspects thread plug gauge with L. H. Walker, Standard Oil industrial engineer. Lyman Walker has been working with customers for 25 years helping them solve problems like the one at Argus. A native of Detroit, Lyman Walker is familiar with the lubrication problems of industry in the territory he serves. This together with his wide experience makes him ideally qualified for this work. Customers find his experience pays off *for them.*

helpful suggestions

FOR MODERN FORGING PROCEDURE



You are invited to have your name placed on our mailing list to receive this valuable series of articles on up-to-date forging methods and procedures. We will be glad to send a complete set of all sixteen issues of "The Forger" in addition to placing your name on our mailing list to receive future articles as they are prepared. There is absolutely no charge for this service. We are glad to make this good will contribution to the advancement of modern forging practice as executed on ACME XN Forging Machines.



THE HILL ACME COMPANY

ACME MACHINERY DIVISION • **1209 W. 65th St., Cleveland 2, Ohio**
ESTABLISHED 1892

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

A 48 x 36 Cecostamp is making road signs, metal ceilings, auto body parts, roofing trim and grain bins at an up-to-date metal stamping concern in Canada.

Formerly made on a rope drop hammer, these stampings as produced on the Cecostamp are sharper and more distinct, production has been increased up to 10% and rejects have been greatly reduced, saving time and material. Operation is also easier and safer.

Have you a stamping problem that might be solved by installing Cecostamps? Investigate this air-operated impact type drop stamp, using blows of controlled intensities, the control being completely and instantly at the will of the operator.

Write for a copy of our latest Bulletin No. 30-L-5

Above are a few of the familiar road signs produced on the versatile Cecostamp.

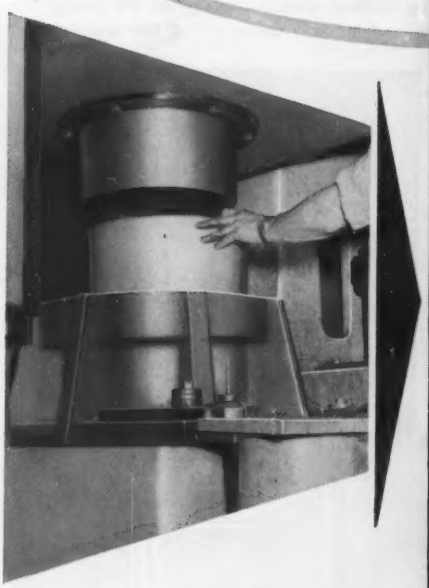
CHAMBERSBURG CECOSTAMP

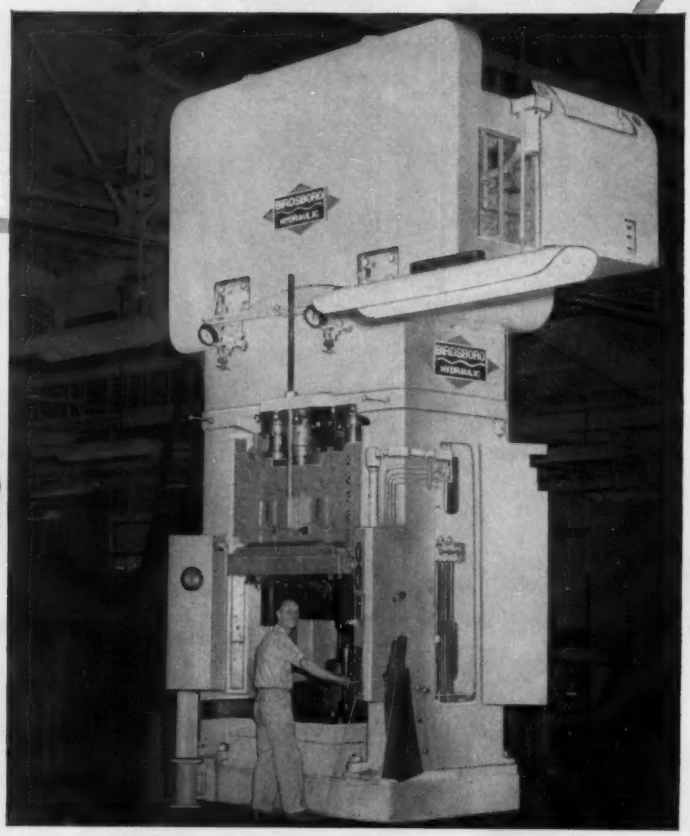
CHAMBERSBURG ENGINEERING COMPANY • CHAMBERSBURG, PENNSYLVANIA

From "bulging" cream separator supply cans...

...to "drawing" seed hoppers for corn planters

INTERNATIONAL HARVESTER relies on a **BIRDSBORO Hydraulic Press**





Designers and Builders of:

STEEL MILL MACHINERY
HYDRAULIC PRESSES
CRUSHING MACHINERY
SPECIAL MACHINERY
STEEL CASTINGS
Weldments "CAST-WELD" Design
ROLLS: Steel, Alloy Iron, Alloy Steel

• Recognized specialization in press design enables BIRDSBORO to offer you made-to-order production help on a vast variety of products.

Whatever your products or problems, it's wise to see what BIRDSBORO can do for your plant operations.

HP-16-54

BIRDSBORO

BIRDSBORO STEEL FOUNDRY & MACHINE CO., BIRDSBORO, PENNA. Offices in Birdsboro, Pa. and Pittsburgh, Pa.

SNYDER SEGMENTED AUTOMATION in 91 station, 182 operation, in-line transfer machine features four segments which can operate independently or as a unit to assure continuous production of automotive automatic transmission cases at 100 cases an hour at 80% efficiency

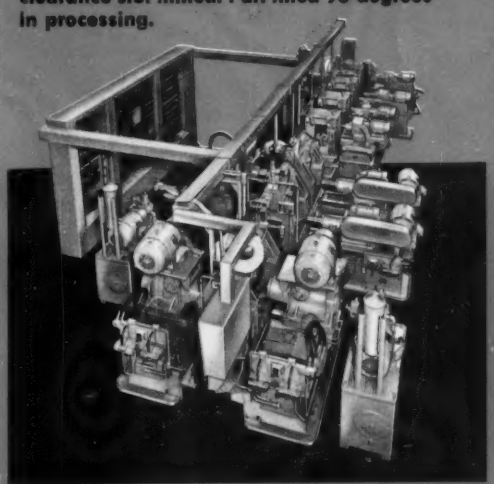
SNYDER

TOOL & ENGINEERING COMPANY

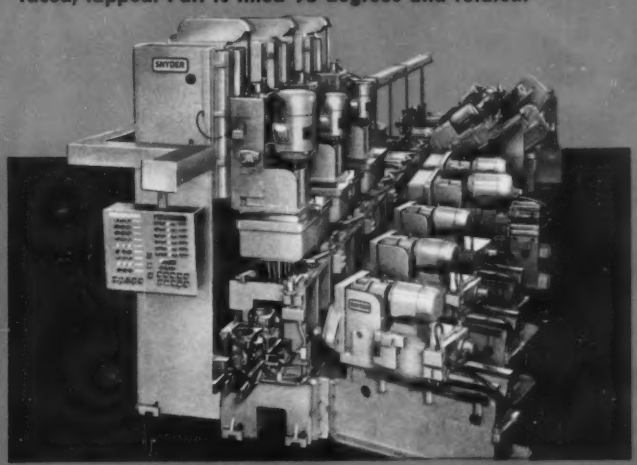
3400 E. LAFAYETTE, DETROIT 7, MICHIGAN

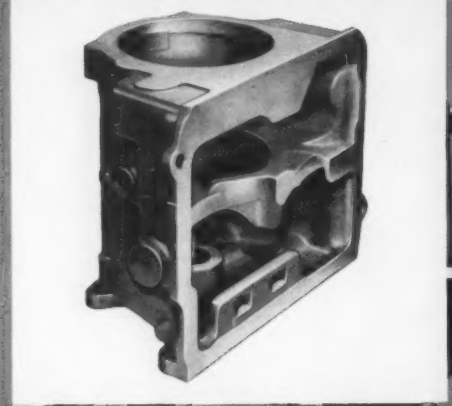
30 Years of Successful Cooperation with Leading American Industries

SEGMENT 1: 40 feet long, 19 stations, 10 spindles. Part manually loaded, both ends face milled, counterbored, three diameters rough and finish bored and faced, two pads side milled, pump pad face milled, clearance slot milled. Part tilted 90 degrees in processing.



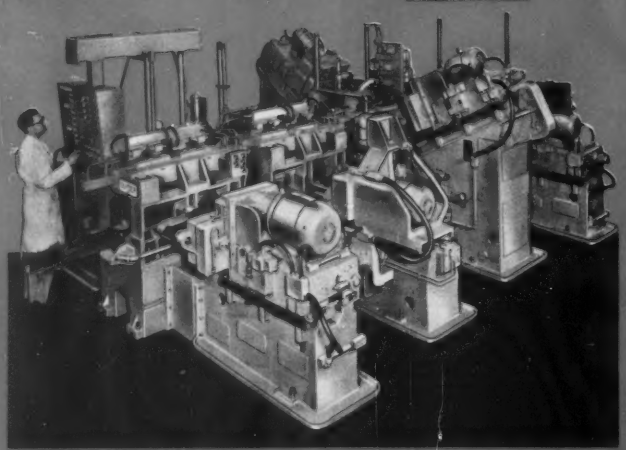
SEGMENT 2: 47 feet long, 31 stations, 91 spindles. In top face, end and at angular locations inside, 51 holes are drilled, countersunk, semi-finish and finish reamed, spotfaced, tapped. Part is tilted 90 degrees and rotated.

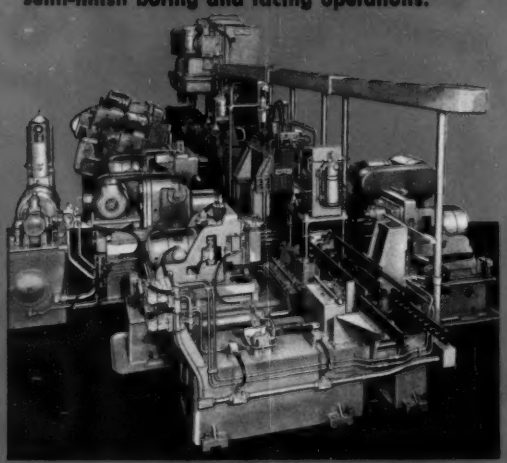




SEGMENT 3: 26 feet long, 17 stations, 21 spindles. Various drilling, chamfering, tapping, counterboring, reaming, spotfacing operations in both case sides. Part removed from transfer bar to special fixture and tipped 45 degrees to process angular inside hole, returned to transfer bar, turned 90 degrees, tilted 90 degrees to bring pump face up.

SEGMENT 4: 36 feet long, 24 stations, 60 spindles. Various drilling, chamfering, tapping, semi-finish boring and facing operations.



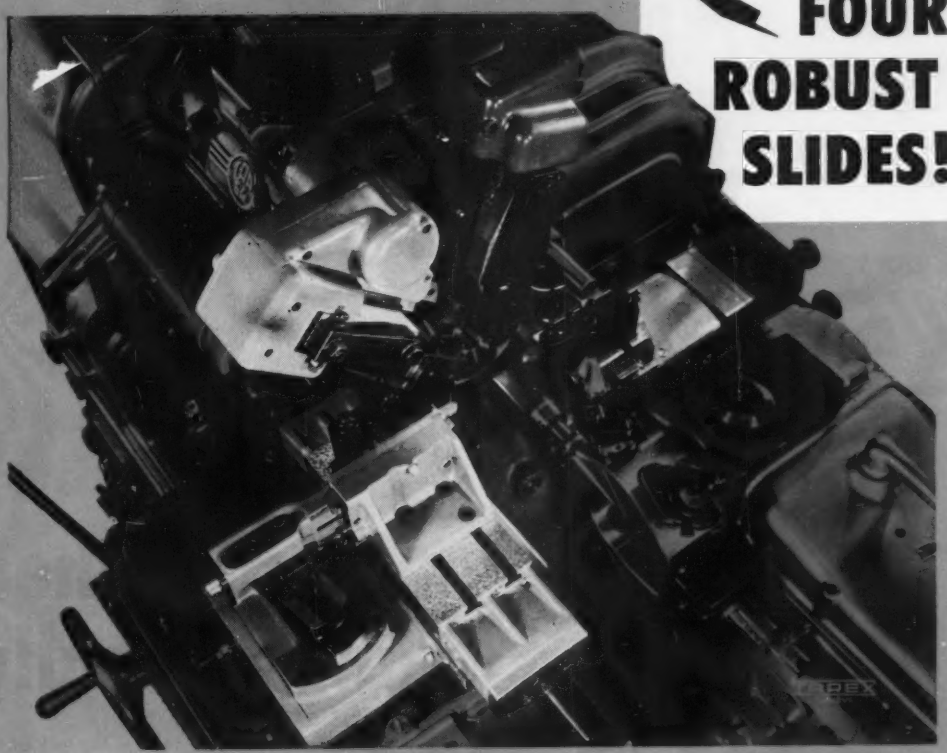


TAREX

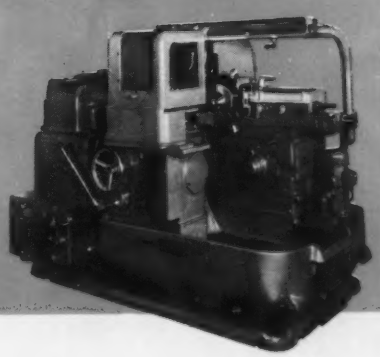
AUTOMATICS

. . . here's JUST ONE of the salient features of this machine which is made with SWISS PRECISION throughout:

FOUR ROBUST SLIDES!



The front and rear slides mounted on crossed ways, *permitting radial or lateral movements, or combined to produce tapers or irregular forms.* This allows the use of single point tools in many cases in place of form tools with their inherent side thrust. All tool slides actuated by camming systems having adjustable ratios. (The two upper slides are radial only). Machine throughout is engineered to take American-made tools!



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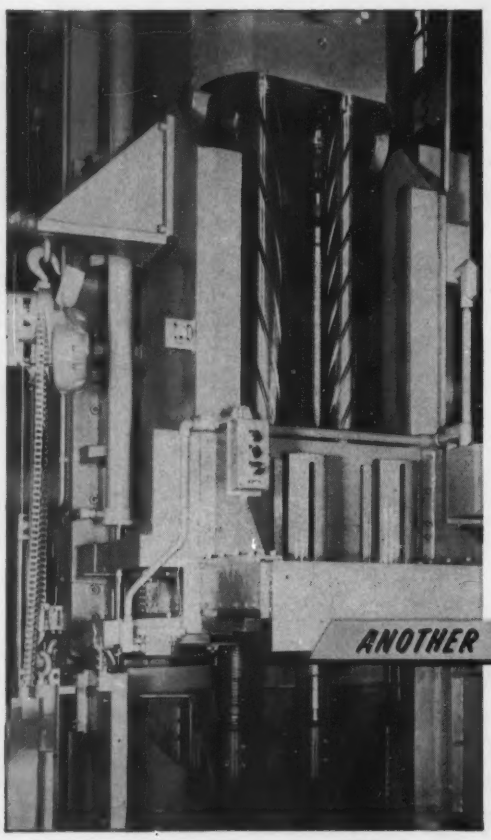
RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

QUALITY GEARS for QUIET TRANSMISSIONS



...broached automatically

Producing quality internal helical gear teeth is the task of two Colonial 2-station RUF-50-72 pull-up broaching machines. All gears are automatically loaded from cartridges and automatically unloaded, with the larger diameter gears being broached two at a time on each station. These quiet transmission gears with three different leads and diameters, have two left hand and one right hand spiral. All three different gears may be broached as production demands on either of the two stations.

Broaches are guided on both ends through full length of cut; broach handling is automatic with safety interlock. Colonial broaches for these gears weigh as much as 800 pounds, and are 81 inches long. Broaches return through a retractable brush and a pressure spray washes chips away. An electric hoist mounted on a universal loading arm handles these broaches in and out of the machine. A cooler for cutting oil, a magnetic chip separator, and an automatic chip conveyor are also furnished on these two Colonial pull-ups.

ANOTHER EXAMPLE OF COLONIAL UNIFIED BROACHING

COLONIAL BROACH & MACHINE CO. DETROIT 13, MICH.

It MUST have been good!

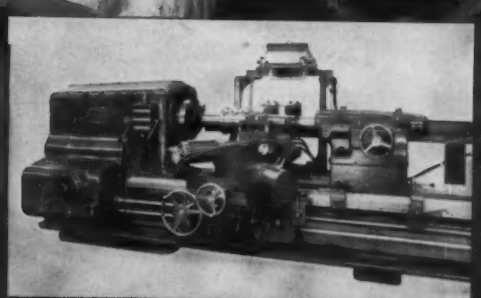
There are times when expressions speak louder than words.

Here's a group of distinguished steel mill roll executives watching a demonstration on a 26" Capacity "AMERICAN" Hydraulic Roll Lathe—judge for yourself whether or not they are satisfied with what they saw.

These machines are performing "miracles" in savings in many of the best known roll shops in the country. They have introduced a brand new machining technique that has revolutionized the art of roll turning. They reproduce work shapes from a template faithfully and accurately not only on steel mill roll bodies and necks, but on such work as spindles, motor shafts, valve stems, step shafts, piston rods, axles and a wide variety of chucking work having irregular contours.

Evidence from hundreds of installations proves beyond a shadow of a doubt their leadership as top-flight cost reducers. Was there ever a time when cost reduction was more urgently needed?

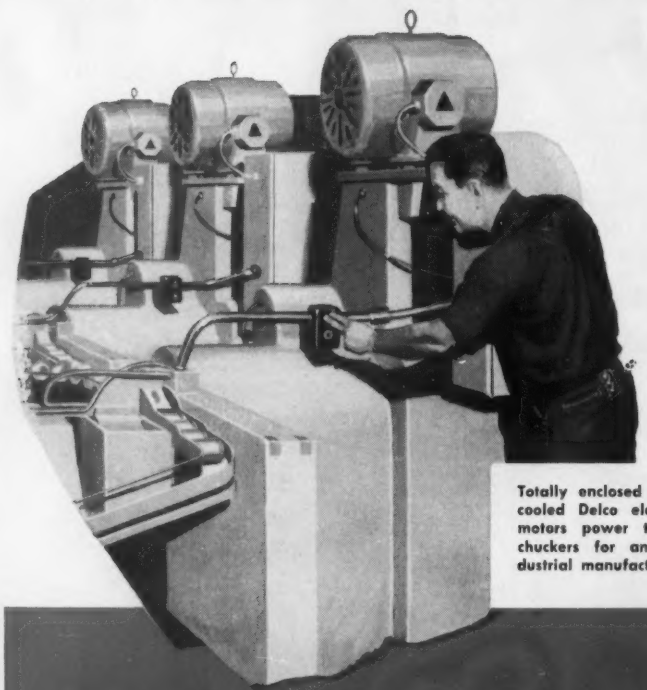
If this proof you want just drop us a line—no obligation.



THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

For top performance,

DELCO



Totally enclosed fan-cooled Delco electric motors power these chuckers for an industrial manufacturer.

An electric motor proves itself by performance. And performance proves that Delco electric motors work harder, last longer, cost less to maintain.

Every Delco motor—from fractionals through the largest integrals—is built to exacting standards of workmanship . . . backed by almost half a century

★ *See Delco national advertising in The Saturday Evening Post for the story of the full Delco electric motor line.*

Open Ball Bearing, Drip-Proof Motors

Open Ball Bearing, "D" Flange Mounting

industry has found that it's

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of skilled design and engineering experience. Our design engineering service job-fits the proper electric motor to every specific industrial need—helps to specify the right motor for every operation. Delco Products engineers will work with your engineers to give you complete satisfaction. And you can be sure that Delco delivery, too, will be exceptionally good. All the more reason why *you should standardize on Delco electric motors.*

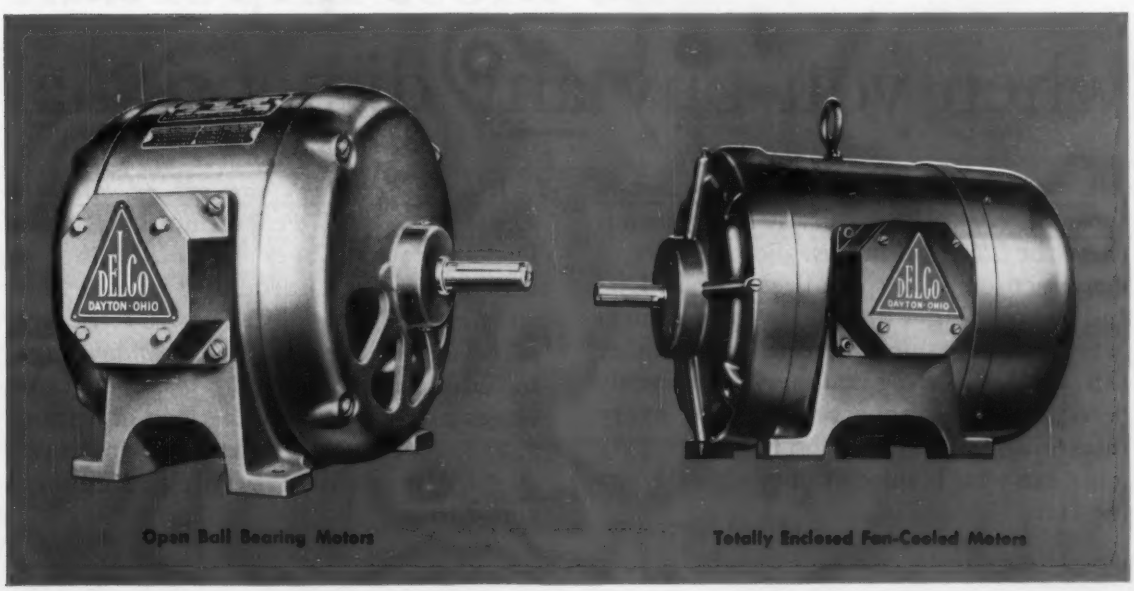
DELCO
DAYTON OHIO

GM GENERAL MOTORS DELCO DAYTON, OHIO

DELCO *Electric* MOTORS

DELCO PRODUCTS, DIVISION OF GENERAL MOTORS, DAYTON, OHIO

Proved best by Performance!



Open Ball Bearing Motors

Totally Enclosed Fan-Cooled Motors

The most important when you buy any dimensional

When a manufacturer makes only certain types of gages, he naturally recommends these for *all* applications. For instance, a manufacturer who specializes only in Dial Indicating Gages obviously cannot meet every modern gaging requirement. Neither can an Air Gage manufacturer honestly recommend his type of gage for every measuring job. Those who buy the wrong gage can't be blamed if they don't know the facts.

Where, then, can you get an unbiased recommendation? Federal not only makes Dial Indicating Gages and an Air Gage — the Dimensionair, unequalled for jobs when an air gage is required — *BUT Federal makes a complete line of ALL modern gages* including Dial Indicating Gages and Air Gages as well as combinations of various gaging and sorting systems for in-process gaging, machine control, and general automation.

consideration

gage . . . .

Before you decide what gages you need, bring your problems to Federal. Our engineers, without bias, will suggest the *best* solution . . . and may save you considerable money. Write or call us today.

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Dept. 3K, Providence 1, Rhode Island

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5 Sizes
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4 Ranges

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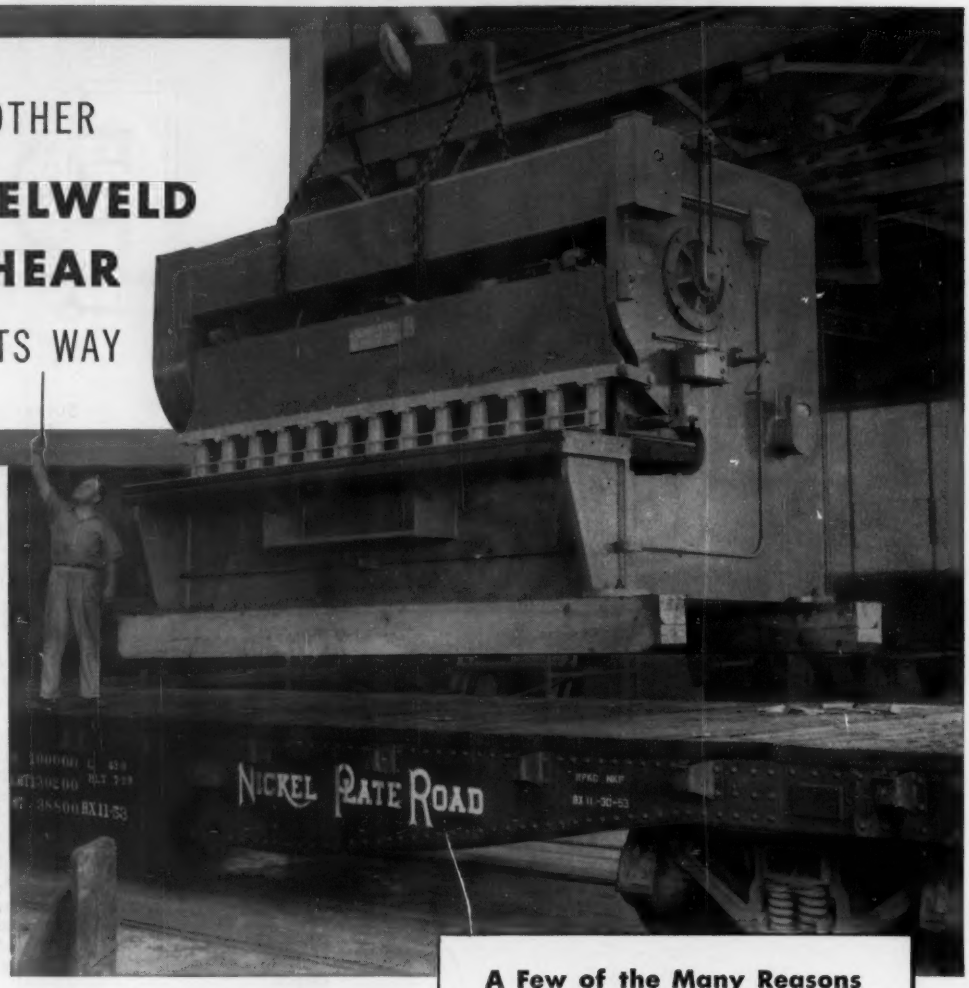
ANOTHER

STEELWELD SHEAR

ON ITS WAY



From every angle a Steelweld shear looks good — and is good. This machine is rated for 12'-0" x ½" steel

SHIPMENTS are being made at a rapid rate to all parts of the country because more and more users are learning of the many merits of Steelweld Shears and are talking about them. As the words of experience spread about and comparisons are made, more and more people come to realize that Steelweld Shears are really outstanding.

For smooth, accurate burr-free cutting, Steelwelds can't be beat. For ease of operation they have no peer. Their heavy construction and means for simple, easy maintenance assure long trouble-free life.

For the finest in shearing, you can't make a better selection than Steelweld. Say the word and we'll have one of these wonderful machines on the way to you.

A Few of the Many Reasons For STEELWELD'S DEMAND

1. Pivoted-blade operation. Entirely different from every other shear. No slides or guides to wear and cause inaccuracies.
2. Micro-set knife adjustment. Quick easy knife-clearance adjustment for every plate thickness. Something not matched elsewhere. Be sure to get the complete story on this.
3. Mechanical hold-downs. Tight gripping, non-leaking, quiet operating.
4. Accurate easy operating back gauge rides on ball bearings.
5. Cool-operating, long-life, low-inertia clutch and brake.
6. Heavy all-welded rigid one-piece steel frame.

AVAILABLE FOR PLATE LENGTHS TO 24 FEET AND THICKNESSES TO 1½ INCH

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

5451 EAST 282 STREET, WICKLIFFE, OHIO

STEELWELD PIVOTED BLADE SHEARS

All belt and two yards wide

(Guard lifted and coolant flow stopped to reveal belt action.)

PHOTOGRAPHED AT BELL AIRCRAFT CORPORATION.

86 inches wide, in fact—by 138 inches long... *all* belt! Here's why: to generate taper of the required precision on huge aluminum aircraft "skins," conventional milling methods were far too slow and costly. So CARBORUNDUM abrasive engineers, in collaboration with the Air Force, Bell Aircraft Corporation, and the Hill-Acme machine people, designed and produced this special belt, in proper gradings to meet the rigid specifications of surface finish and dimensional accuracy.

● If *you* are stymied by an unusual grinding problem, turn to the source with the greatest experience and application "know-how" in the abrasive field today! Call in your CARBORUNDUM Distributor or salesman, or write The Carborundum Company, Niagara Falls, New York. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ont.

Through application "know-how" and product quality

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar

Three cheers for the red, white and cool

The "see-through" safety guard was specially made for this photo only.

Distinctive RED blotter on a new WHITE wheel is the sign of COOL tool grinding worth cheering about! And that's not all...V40 Bond Tool Room Wheels by CARBORUNDUM cut faster, last longer and permit heavier infeeds without burning the stock or overheating the tool, even on die steels and hi-vanadium types. And the outstanding form-holding ability of V40 Bond Wheels eliminates costly stops for wheel dressing halfway through a job. Try one in your shop today. There's a type for every tool room operation...easily identified by the V40 on the bright red blotter. Your CARBORUNDUM Distributor or salesman will arrange a free demonstration. For Bulletin A-1310, write The Carborundum Company, Niagara Falls, New York. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ontario.

Through product quality and application "know-how"

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continually puts more sense in your abrasive dollar

Don't Let Small Parts Clutter Up Your BROACHING OPERATIONS

OIL GROOVES
SMALL SPLINES
SERRATIONS
KEYWAYS
SLOTTING
BURRING
SIZING HOLES

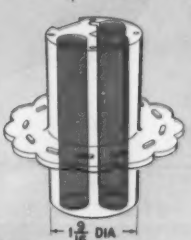
These can all be broached AT FAR LESS COST on Red Ring Self-contained Broaching Fixtures. Use your standard broaching machines for the heavier jobs on which they pay off.

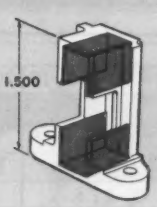
The Self-contained Fixture has its own pneumatic power unit to pull or push the broach. Just set it on a table, connect it to the air line and you are ready to start broaching. Or you may want to mount it vertically to further economize floor space.

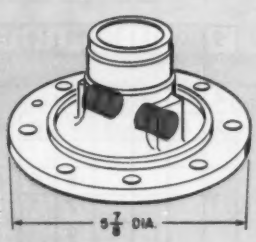
Like other fixtures or dies, these units may be stored in the tool room when not in use. They occupy little space and are easily portable.

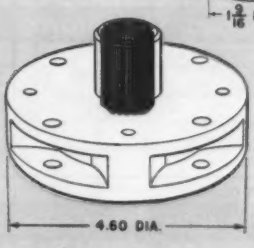
Application is practically unlimited for jobs requiring a "Pull" of 2,000 lbs. or less and a stroke not exceeding 25 inches.

Call a Red Ring Broach Engineer or write for Bulletin B54-9 for more detailed information.









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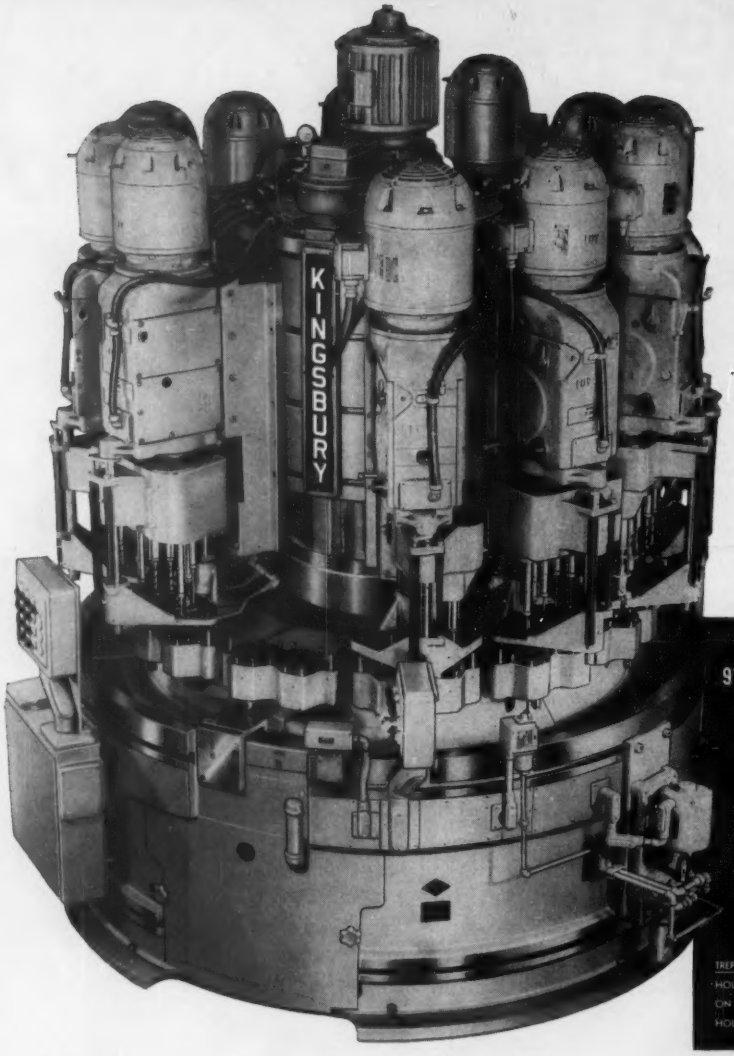
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.
5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

7018

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

"Operations Kingsbury" in these two machines



Floor space occupied by each of these Kingsburys has an extremely high production ratio. Here's the story in table form:

Part	Number of Operations	Number of Work Units	Average Sq. Ft. per Unit	Parts per Hour Gross
Valve Plate	91	11	10.0	450
Venturi Cluster	12	12	9.7	600

Steel plate valve featured here measures approximately 5 3/8 inches diameter and 5/32 inch thick. It has 23 holes, 10 of which are previously pierced. Print called for seven basic operations as shown in the blueprint and in Table 1 below. Production output is 360 pieces per hour at 80% efficiency. This is an average of one finished piece every 10 seconds. And since there are

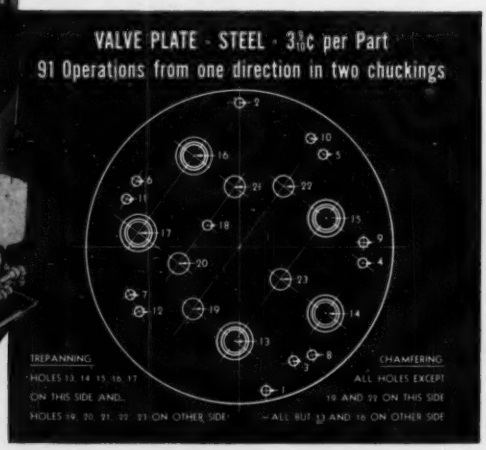

VALVE PLATE - STEEL - 3 3/10¢ per Part
91 Operations from one direction in two chuckings
TREPANNING
HOLES 13, 14, 15, 16, 17
ON THIS SIDE AND
HOLES 18, 20, 21, 22, 23 ON OTHER SIDE
CHAMFERING
ALL HOLES EXCEPT
19 AND 22 ON THIS SIDE
ALL BUT 13 AND 16 ON OTHER SIDE

TABLE 1 91 OPERATIONS	HOLES — 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
FIRST CHUCKING, FACE SHOWN	MACHINE STATION NUMBERS																						
Drill *10 holes pierced	1	1						4	4	4	4	4	*	*	*	*	*	4	*	*	*	*	*
Chamfer	10	10	3	3	3	3	3	5	5	5	5	5	8	8	8	8	8	10		1	1		1
Tap Drill			2	2	2	2	2																
Ream													6	6	6	6	6						
Trepan													7	7	7	7	7						
Chamfer from rear													9			9							
SECOND CHUCKING, PART TURNED OVER	MACHINE STATION NUMBER																						
Chamfer	10	10	2	2	2	2	2	3	3	3	3	3		6	6		6	5	6	8	6	8	8
Tap			11	11	11	11	11																
Ream	1	1						4	4	4	4	4							1	10	10	1	10
Trepan																			5	7	7	5	7
Chamfer from rear																			9			9	
TOTAL OPERATIONS	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4

develop more production in less floor space

91 operations on each piece . . . well, you figure it!

Kingsbury machine has an 81 inch circular base. All spindles are vertical. Units are mounted on a central column, and are located at the periphery of the 60 inch Index Table. This table indexes through 12 stations, one for loading and unloading.

Each part is run through the machine twice. Twin work-holder fixtures present two parts at each work station, where multiple spindles operate the tools.

* * *

You could palm this die casting and do *magic* with it! In fact, considerable "magic" was evidenced in the die, where straight and tapered holes were formed. Our job was to build an automatic machine to drill and finish holes at angles. That's easy enough! But the customer wanted an average production output of 480 finished pieces per hour — and that's *good* magic!

Production output of 480 pieces is 80% of 600 pieces per hour gross, or one every six seconds! Since each piece requires six basic operations, it was necessary to reduce the time for each operation to the minimum cycle consistent with required accuracy.

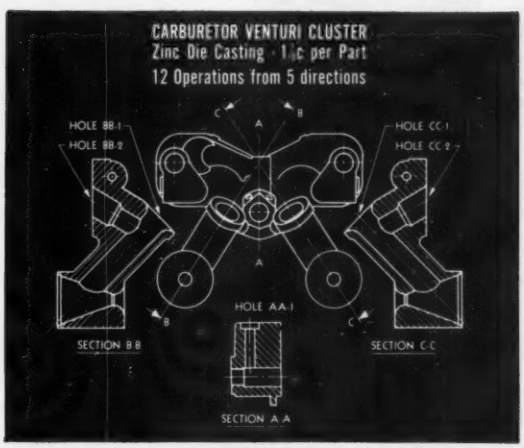
In Table 2 you will note that Holes BB-1 and CC-1 are each drilled in two stages. The burr-reaming operations at two other stations also form the bell-mouths.

Machine has a 96 inch base on which 12 work units are mounted, numbered 2 through 13. Index Table is 30 inches diameter and has 15 work-holding fixtures. Table indexes through 15 stations. Station 15 is for loading and unloading.

* * *

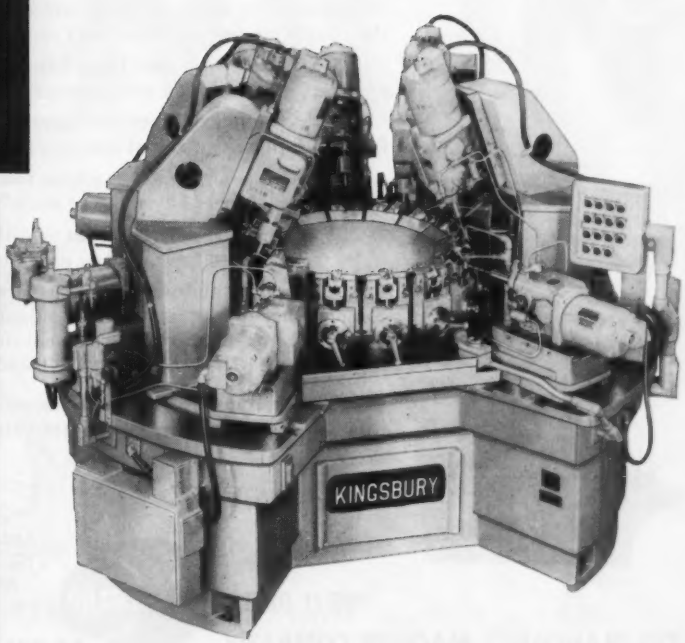
Each Kingsbury is specially designed and custom-built to provide the highest practicable production—at costs which should enable you to write off the capital investment in three years or less. If you have a high production job that's *right* for a Kingsbury, let's get together.

Kingsbury Machine Tool Corp.
112 Laurel Street
Keene, New Hampshire



KINGSBURY
AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production

TABLE 2 BASIC OPERATIONS	Section Holes Numbered				
	AA-1	BB-1	BB-2	CC-1	CC-2
	Machine Station Numbers				
Drill	7-A	2-HR 4-HR	3-AR	9-HL 11-HL	10-AL
Step Drill			3-AR		10-AL
C'bore	8-A				
Burr ream		6-HR		13-HL	
Ream			5-AR		12-AL
Chamfer			3-AR		10-AL
WORK PER HOLE	2	3	4	3	4



Q. Why does Blanchard grind its own machine parts on a Blanchard?

A. It's the only way we know to get highest quality at lowest cost!

Shown here are 117 different parts of a #18 Blanchard Grinder. 239 surfaces on these 117 parts were ground on a Blanchard, for the simple reason that *there isn't any better way.*

Everyone who uses Blanchard Grinders knows that Blanchard elements are machined with extreme accuracy . . . that they *have to be!*

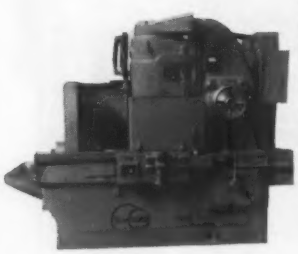
Furthermore, Blanchard users everywhere would undoubtedly agree fully with these two actual statements recently made by customers:

"There is no greater machine tool money value than a Blanchard. It is the best buy we ever made".

"Until our Blanchard went to work, I never realized I could actually save so much, as compared to previous methods of machining flat surfaces".

If you do not own a Blanchard, we invite you to select some of your own components, and let us give you estimates to compare with your present quality control tolerances and machining costs. Chances are you'll find it will pay you to *"PUT IT ON THE BLANCHARD".*

P. S. You guarantee yourself full benefit from your Blanchard Grinders when you use the correct Blanchard abrasive wheels!

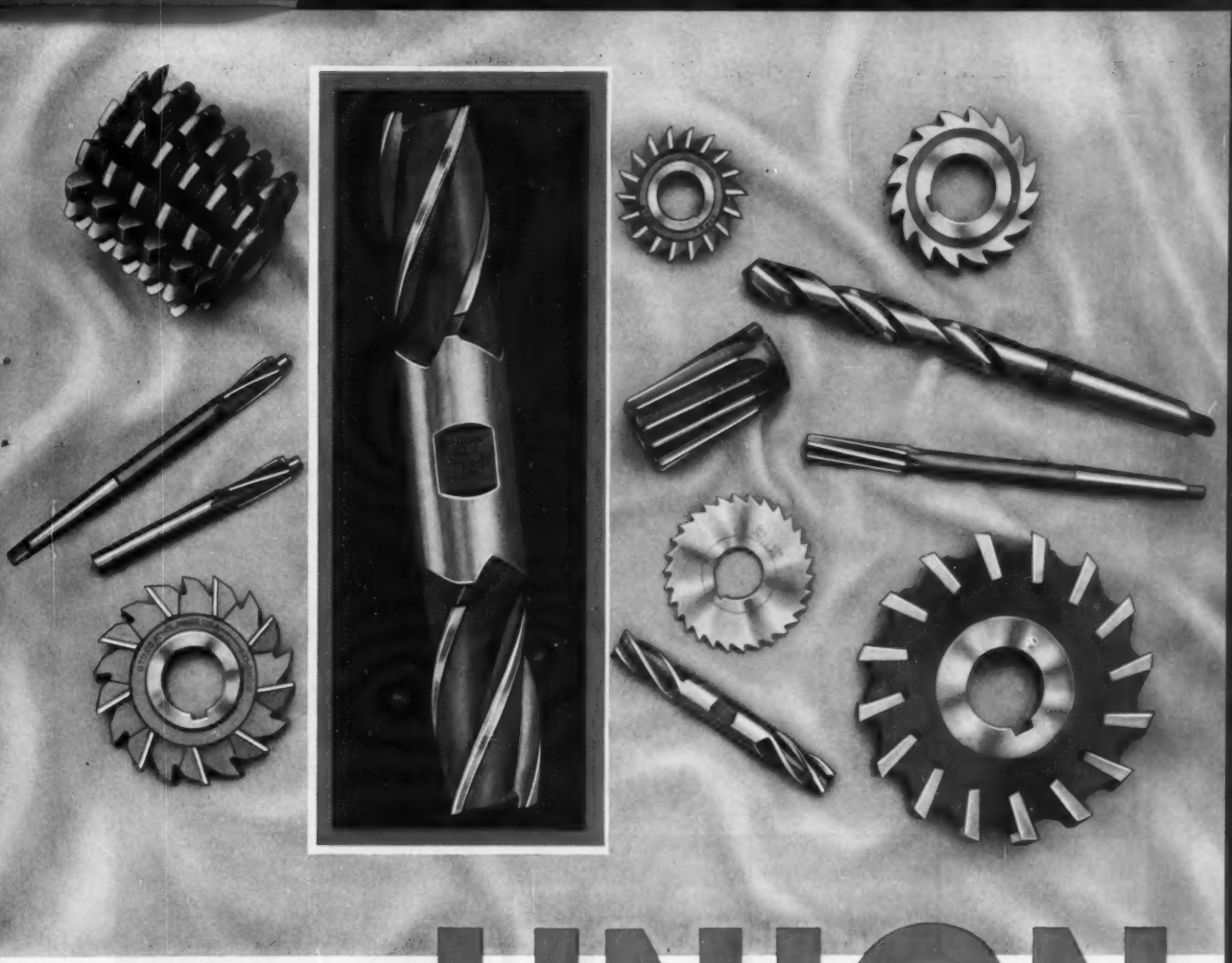


Send for free copies of "Work Done on the Blanchard", (fourth edition), and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

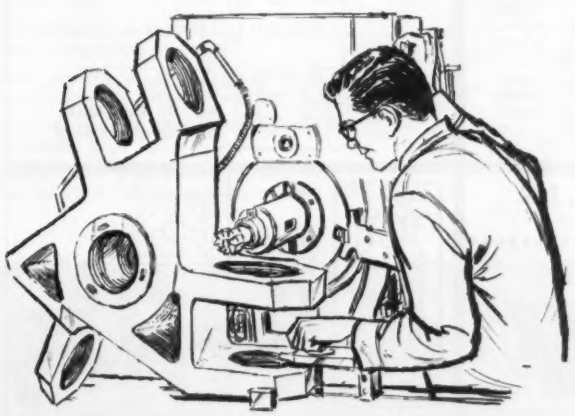
THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.



IN THE METAL WORKING INDUSTRY, IT'S

UNION



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FOR
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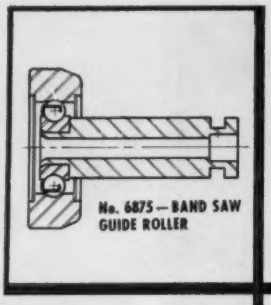
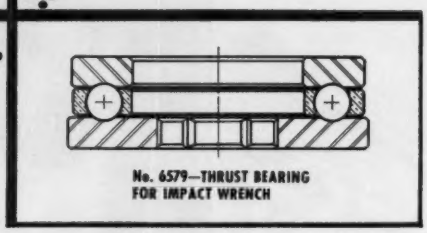
CALL YOUR UNION DISTRIBUTOR

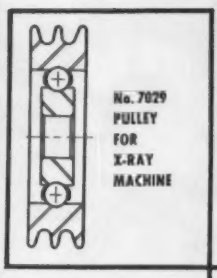
UNION TWIST DRILL COMPANY • ATHOL, MASSACHUSETTS

OWNERS AND OPERATORS OF: S. W. CARD MANUFACTURING CO. DIVISION, Mansfield, Mass.
BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec

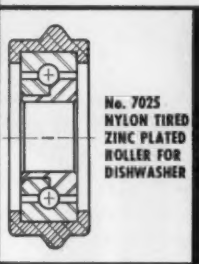
No. 6997 SPECIAL OVERHEAD TRACK TROLLEY WHEEL


No. 6875—BAND SAW GUIDE ROLLER

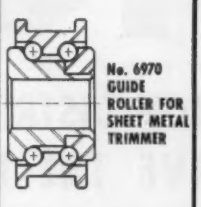

No. 6579—THRUST BEARING FOR IMPACT WRENCH

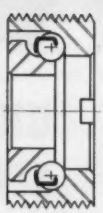

No. 7029 PULLEY FOR X-RAY MACHINE

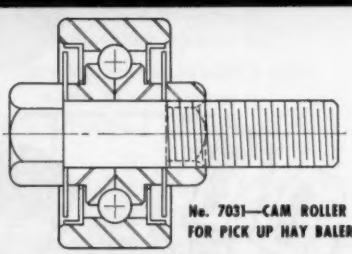
Have you investigated the design and cost saving opportunities offered by


No. 7025 NYLON TIRED ZINC PLATED ROLLER FOR DISHWASHER

NICE...


No. 6970 GUIDE ROLLER FOR SHEET METAL TRIMMER


No. 6959 THREADED O. D. CADMIUM PLATED BEARING FOR RADIO TUNING DEVICE

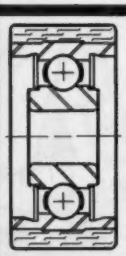

No. 7031—CAM ROLLER FOR PICK UP HAY BALER

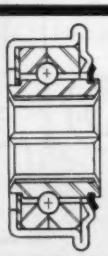
Write for Catalog No. 150

NICE

NICE BALL BEARING CO.

NICETOWN • PHILADELPHIA • PENNSYLVANIA


No. 7028 NEOPRENE TIRED ROLLER FOR DICTATING MACHINE


No. 6768 BEARING FOR CONVEYOR ROLLERS

Standard and Special Ball Bearings Since 1902

For more information on products advertised, use Inquiry Card, page 239

YOU DON'T CUT ANY FASTER...

you just finish the job sooner

and at lower cost per piece

Most *good* modern machines will cut as fast as today's carbide and high-speed tools will take it, so your actual time per cut will be the same, regardless of the machine you use. But when you put jobs like this on an

Acme-Gridley Fully Automatic Turret Lathe

you *finish them faster* because non-cutting (idle) time is accelerated and controlled. The complete machining cycle is entirely automatic and predetermined—to give the minimum time per piece, on *every piece*. Machining is done at the surface speed best suited for required finish and tolerance because each toolslide is independently cammed and selective spindle speeds are automatically controlled.

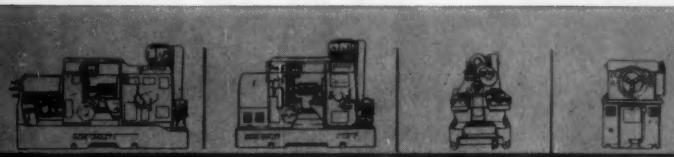
Ask us to show you how *automatically controlled cycle** can turn non-productive "idle" time into savings like this—on your jobs.

JOB FACTS

- **PACKING GLAND NUT from 4¼" round 1112 C.D. Steel.**
- **12 OPERATIONS (with 9 tools) including threading and tapping.**
- **FORMER METHOD produced 409 pieces in 192 hours on hand operated machine.**
- **ON MODEL M ACME-GRIDLEY—325 pieces in 48 hours.**
- **SAVINGS—7 to 2 production increase at better than 3 to 1 savings in cost per piece.**

Automatically controlled cycle
IS **STANDARD** ON ALL ACME-GRIDLEYS.

Send for Catalogs M-50A and MC-53



OUR JOB: to provide the *Right Machine* for YOUR JOB

Acme-Gridley 4, 6 and 8 Spindle Automatic Bar and Chucking Machines • Fully Automatic Turret Lathes (Bar and Chuck Type) • Hydraulic Thread Rolling Machines • Automatic Threading Tools • Switches • Solenoids • Contract Manufacturing.

THE NATIONAL ACME COMPANY

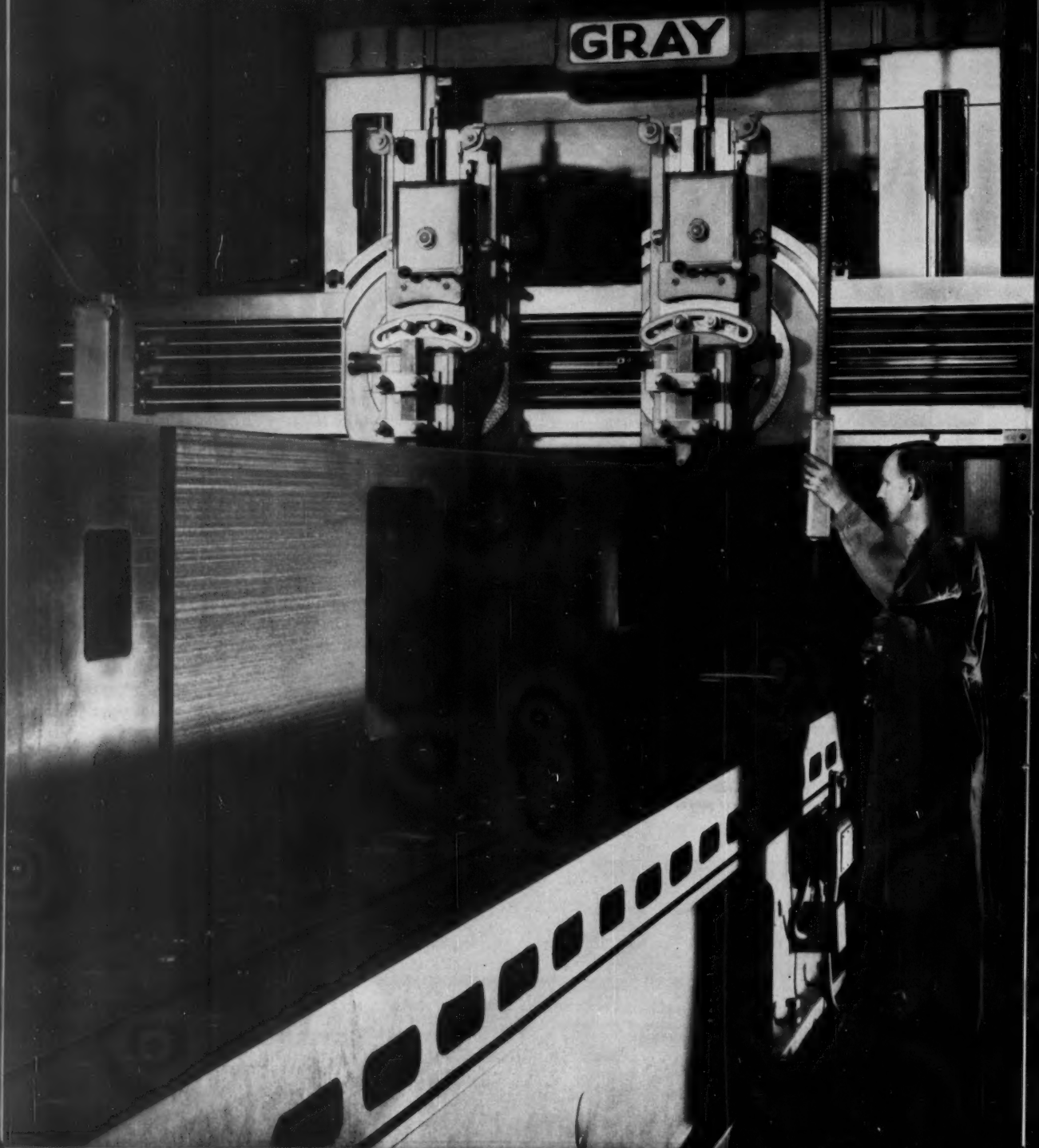
179 EAST 131st STREET • CLEVELAND 8, OHIO

Magnificent monster

The GRAY is recognized by machine shops throughout the world as the ultimate in planers. Built for high production with great precision, it combines more original engineering developments and production features than any other planer. It is in such demand that GRAY is the largest planer builder, further proof that

Quality doesn't cost . . . it pays.

The G. A. GRAY Co., Cincinnati, Ohio.



Never a shutdown to oil this Welsh Plug machine because Farval's on the job

FARVAL—
Studies in Centralized Lubrication
No. 175

THIS machine drives seven Welsh Plugs into the block of a well-known automobile engine. Uninterrupted operation is essential to its smooth performance as part of the automated line.

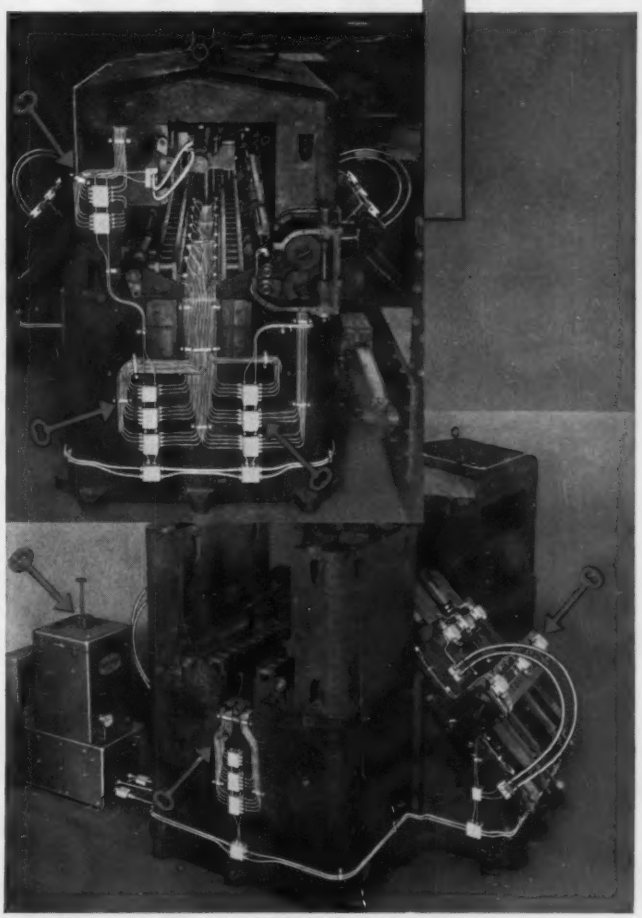
That's the reason the builder installed Farval Centralized Lubrication. These photographs were taken before final assembly of the machine, to show the extensive, orderly arrangement of Farval lubricant lines and valve manifolds serving 207 vital bearings—failure of any one of which would cripple the operation.

Now in service, the Farval system lubricates the machine automatically from the pumping station located at the left. It delivers a measured amount of oil to each bearing, as often as desired, while the machine itself is operating. Never a shutdown for lubrication! And no special oiler is needed.

Farval Automatic Lubrication is the ideal system for automation in any industry. The Farval Dualine valve placed at each bearing is simple, sure and foolproof—only two moving parts, without springs, ball-checks or pinhole ports to cause trouble. Its value proved by more than 27 years of successful service, Farval lubricates millions of industrial bearings.

Let us send one of our lubrication engineers to analyze your plant equipment and help you determine how Farval can serve you. Just drop us a line. Ask also for Bulletin 26. The Farval Corporation, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.



KEYS TO ADEQUATE LUBRICATION—Wherever you see the sign of Farval—the familiar central pumping station, dual lubricant lines and valve manifolds—you know a machine is being properly lubricated.

These photographs of a Welsh Plug Assembly Machine, showing Farval lines and valves on both sides, by courtesy of the builder, Sainte Claire Tool Company, Detroit, Michigan.

For more information on products advertised, use Inquiry Card, page 239

GIANT SIZE!

THE GIANT SIZE **Sellers Floor Type Horizontal has:**

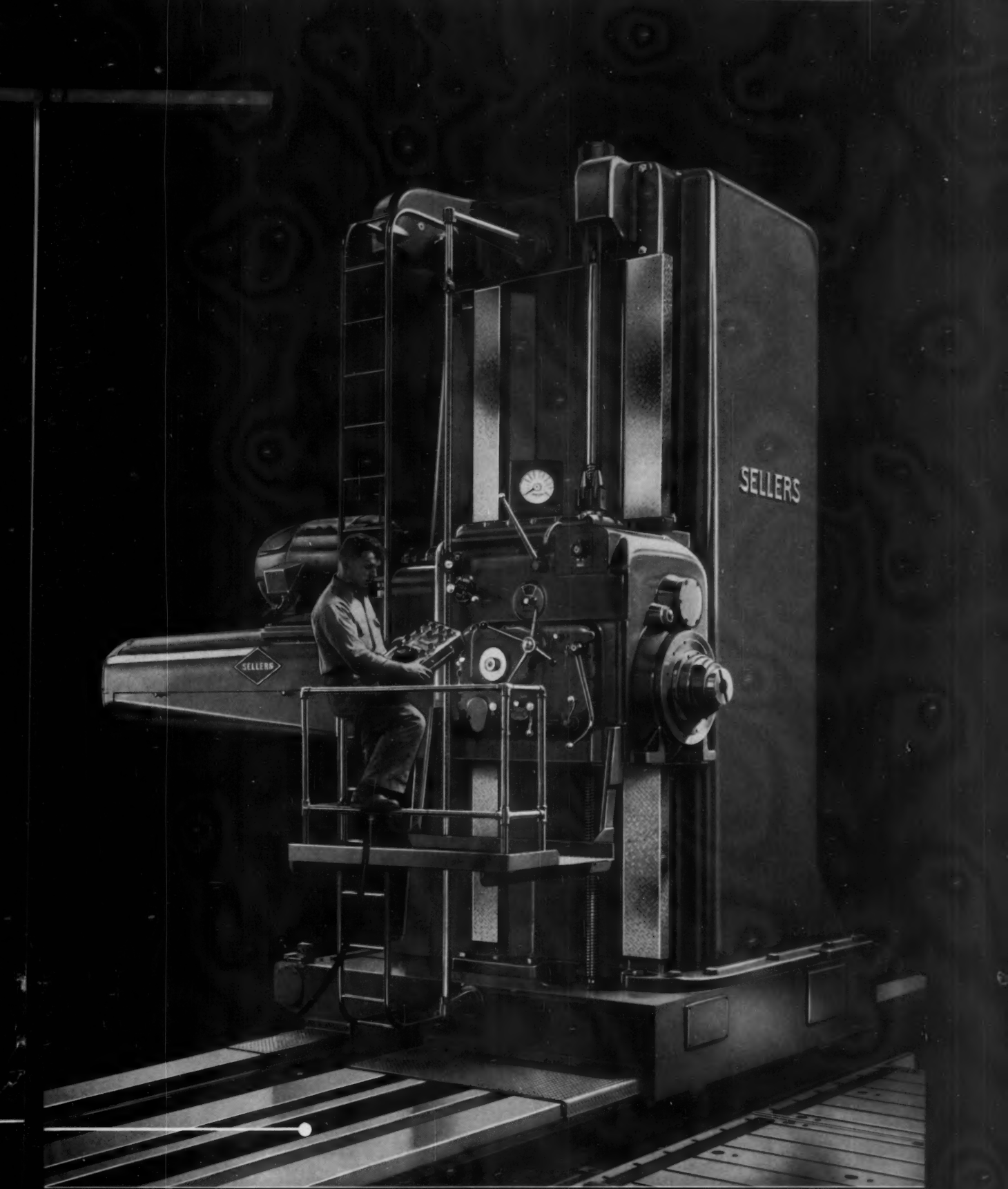
A 10 inch diameter spindle
An 8 foot spindle feeding stroke
A runway that measures 9 feet across the ways
A column that measures 4½ feet across its ways
Up to 15 feet of head travel on the column
A 100 horsepower driving motor

It is a big machine for big work, but with its electronic push-button control, it handles like a small one.

CONSOLIDATED MACHINE TOOLS FJB®

CONSOLIDATED MACHINE

A DIVISION OF FARREL-



TOOL COMPANY ROCHESTER 10, NEW YORK

BIRMINGHAM CO., INC.

what can you do when you face

sudden obsolescence?

When competitive pricing forces you to cut costs and replace money-losing machinery, the actual replacement cost may be greater than the depreciation reserve. Worse still, "reserves" may be on paper instead of in the bank, and the old machines may not make the down payment.

Don't wait for this kind of sudden obsolescence to hit.

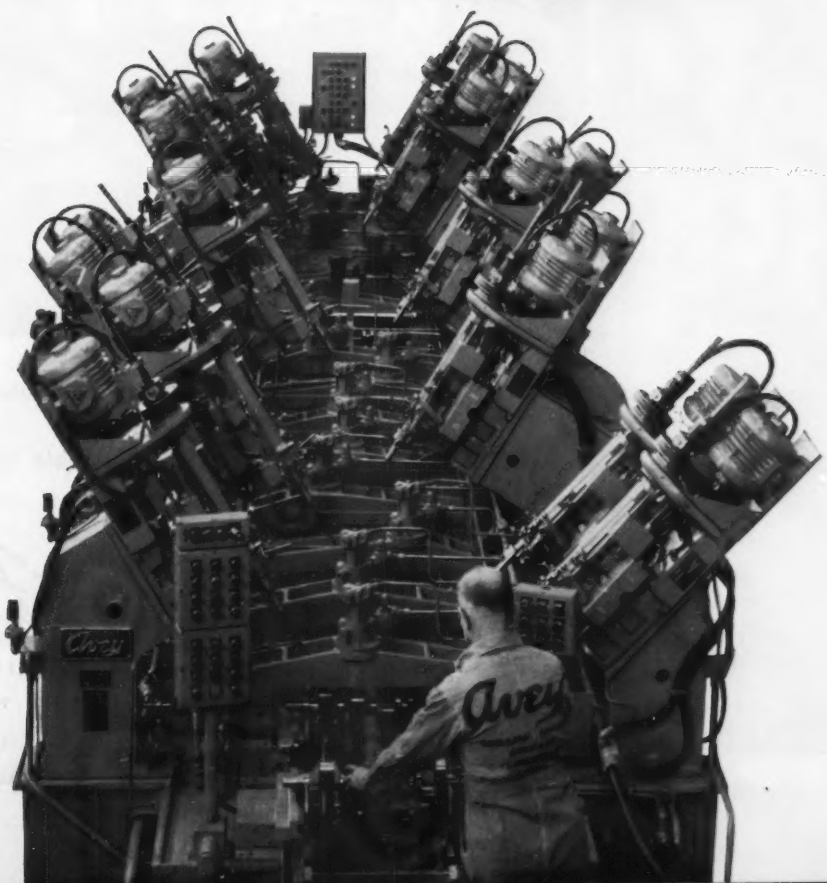
Invest now in fast-earning, high yield Avey drilling machines, which sometimes pay for themselves in 9 months, generally less than 18 months—and then help build reserves for other needed equipment.

Avey machines earn their heads off because they make such surprising cuts in unit costs. Investment per sq. ft. of floor space is unusually modest. Then, when the order is done, you can generally re-engineer the Avey unit heads for another job at moderate cost, and start another profitable chapter in the history of your company. Send us a part print: ask for an Avey *profit prediction*.

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

Avey



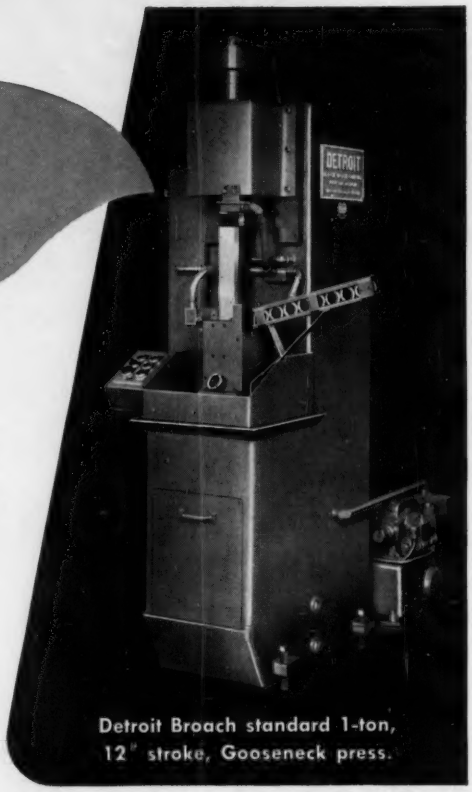
STANDARD DETROIT PRESS

broaches oil groove in

700 BEARING RACES/Hr.

This application shows the versatility of Detroit Broach standard presses. Tooled for automation, parts are magazine fed from the preceding operation, broached and then dropped into a tote basket ***without an operator.*** Parts can also be chute-fed to next operation.

An important advantage of this type of automation lies in the fact that if the operation should be obsoleted, this standard press can be applied, without change, to another operation.



Detroit Broach standard 1-ton, 12" stroke, Gooseneck press.

Detroit Broach standard 10-ton, 30" stroke, Side Plate press.

STANDARD DETROIT PRESSES

for **BROACHING ★ ASSEMBLING ★ STRAIGHTENING**

★ Complete range of sizes and strokes in both Gooseneck and Side Plate presses.

★ Sensitive, positive control of ram speed, force, travel and direction of movement.

★ Rigid construction with compact, fully-enclosed operating mechanism.

★ Simple manual, semi-automatic or fully automatic control.

★ Powered by dependable Oilgear fluid power system.

Detroit Broach COMPANY

ROCHESTER, MICHIGAN

OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

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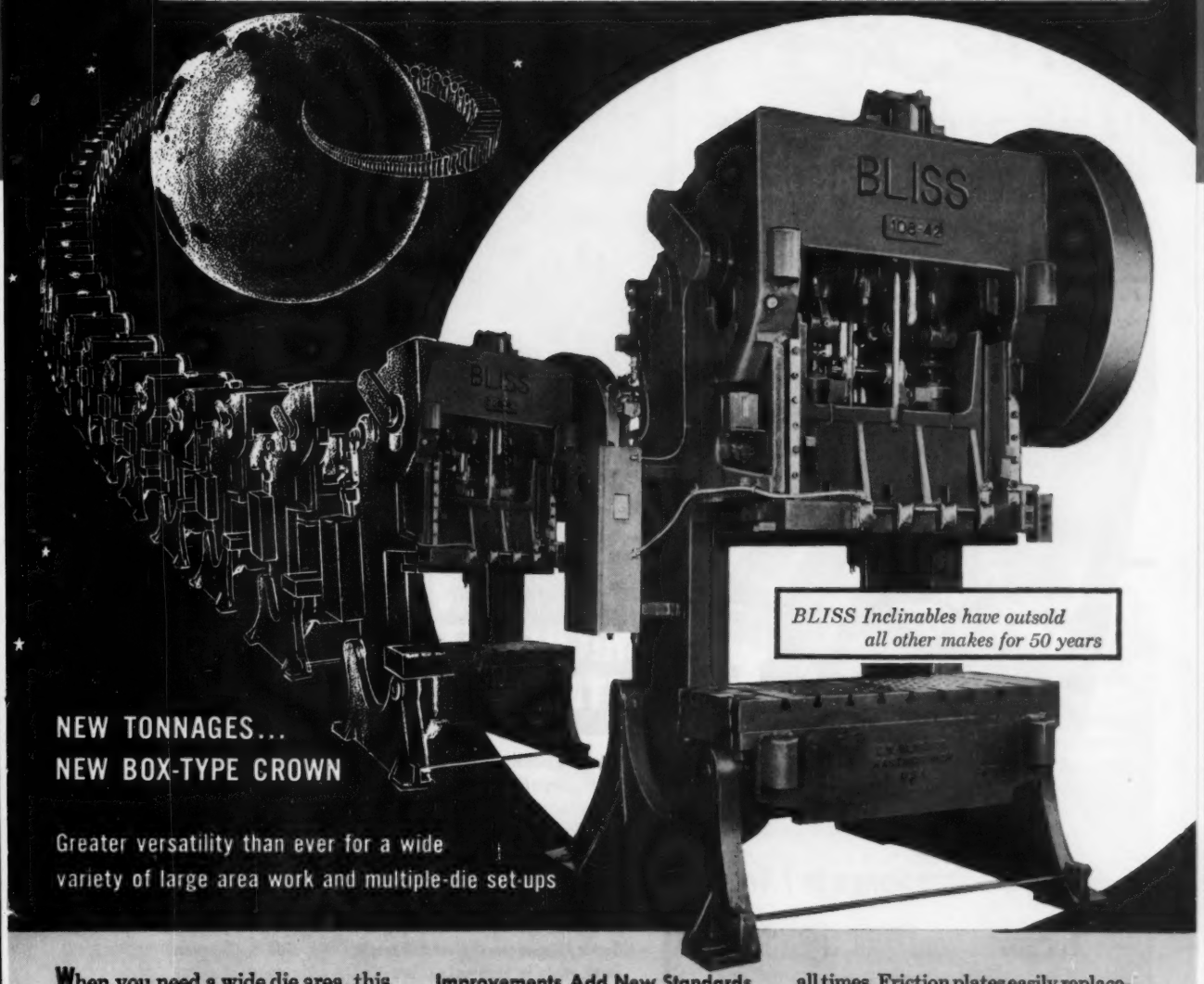
• • • • • • • • • INTRODUCING BLISS' NEW

DOUBLE-CRANK INCLINABLE SERIES



BLISS Inclinables have outsold all other makes for 50 years

NEW TONNAGES...
NEW BOX-TYPE CROWN

Greater versatility than ever for a wide variety of large area work and multiple-die set-ups

When you need a wide die area, this is the press to handle tough blanking, forming, drawing, perforating.

Add a Bliss pneumatic cushion (the press is set up to receive it) and you extend the range of *draw* work.

For high production work, the addition of a Bliss feed (single or double roll, dial) will give you runs of 200 or more strokes per minute.

Improvements Add New Standards of Accuracy

- ***New, Heavy Box-Type Crown*—the same as is used on rugged Bliss automotive presses—adds mass, rigidity ... minimizes deflection. Gives 100% up-snug bearing support. Adds strength through entire cast Meehanite gap frame. Keeps slide in perfect alignment even under unusual off-center loads.**
- ***Air Friction Clutch and Brake*—cool-running. Automatically adjusts for wear, making for fast action between full brake and engagement at all times. Friction plates easily replaceable without tearing down clutch.**
- ***Other Features*—Precision gibbing, roller bearings, extra-heavy ball-seat connections, heavy-duty forged shaft.**
- ***All Parts Available from Stock*—Parts are interchangeable and available from stock through any Bliss sales office.**
- ***Reasonably Priced*—Only Bliss offers a standard double-crank inclinable (to 175 tons) and with it offers the same low cost value as all Bliss Inclinables. Write for catalog and information about our Deferred Payment Plan.**

E. W. BLISS COMPANY, CANTON, OHIO

BLISS
SINCE 1857

is more than a name... it's a guarantee

do your operators have this

Time Saver

to help cut machining costs on stub boring operations?

SET No. 11 ILLUSTRATED
WEIGHT 350 POUNDS

SUPER MICROMETER-ADJUSTABLE STUB BORING TOOL SETS

- 1¼ to 8″ Bore Range in 7 Tools
- Eliminate "cut and try" boring
- Precision adjustment to .0001″
- Reduce setup and tool changes

Your operators always have the right tooling answer at their fingertips—for cutting costs and improving accuracy on non-repetitive boring—when you provide them with Davis Stub Boring Tool Sets. Then time lost at the tool crib is ended. For without once leaving their machines, they can bore from 1¼ to 8 inches, pencil bore from ⅜ to 1¼ inches and do light, extended boring up to 13 inches.

Highest precision and fine finish are assured by Davis Super Micrometer-Adjustable mechanisms used in all seven basic tools in each set. It provides a wide range of cutter adjustments to limits of .0001″ by simply setting the micrometer screw's dial head at the desired reading. Exceptionally rugged construction makes Davis tool sets ideal for either rough or finish boring operations. Learn how this modern tooling idea can save money in your shop.

Write today for Davis Bulletin DB-50.

10 DIFFERENT STANDARD SETS AND MANY MODIFICATIONS READILY AVAILABLE

DAVIS

BORING TOOL DIVISION OF
Giddings & Lewis Machine Tool Co.
Fond du Lac, Wisconsin

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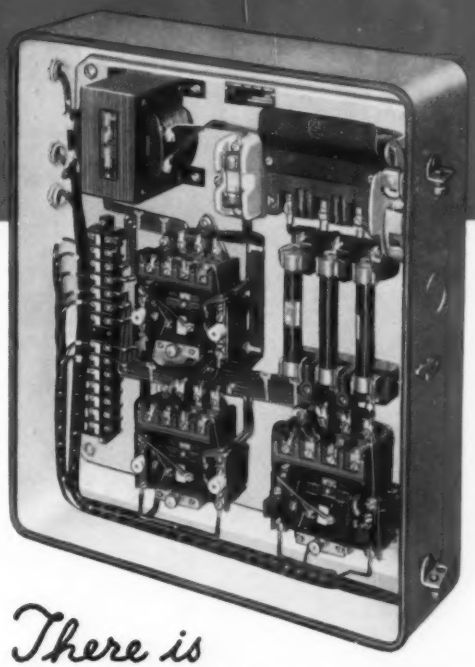
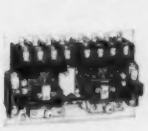
Oakes mixing machine for continuous mixing of raw materials in the rubber and chemical industries.



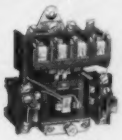
Close-up of Allen-Bradley automatic motor control panel.

The Sign of QUALITY MOTOR CONTROL

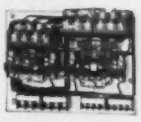
Service-tested Components for Automation Control Panels



Reversing Switch

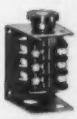


Solenoid Starter



Multispeed Starter

Solenoid Relay

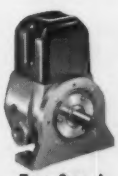


Pilot Switch

Drum Switch

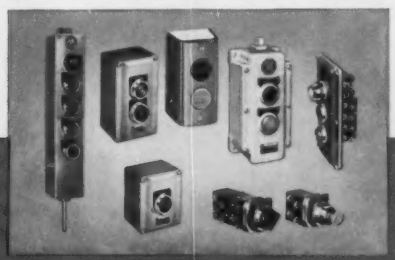
Pneumatic Timer

Pressure Switch



Zero Speed Switch

Limit Switches



Push Buttons

There is

SALES VALUE for YOU in the A-B TRADEMARK

Time has established the A-B trademark as the sign of Quality in motor controls. It is so recognized by the buyers of your motorized machines. So, why not standardize on Allen-Bradley controls.

Years and years of trouble free service in every conceivable industry has proved conclusively that A-B controls are a real sales asset to any machine. You just cannot beat Allen-Bradley controls for simplicity in design . . . your guarantee for reliable and consistent performance.

Whether you need a single starter or an all-inclusive special control panel, call in your nearest Allen-Bradley sales engineer. Let him recommend the components that will assure the most continuous output from your machines.

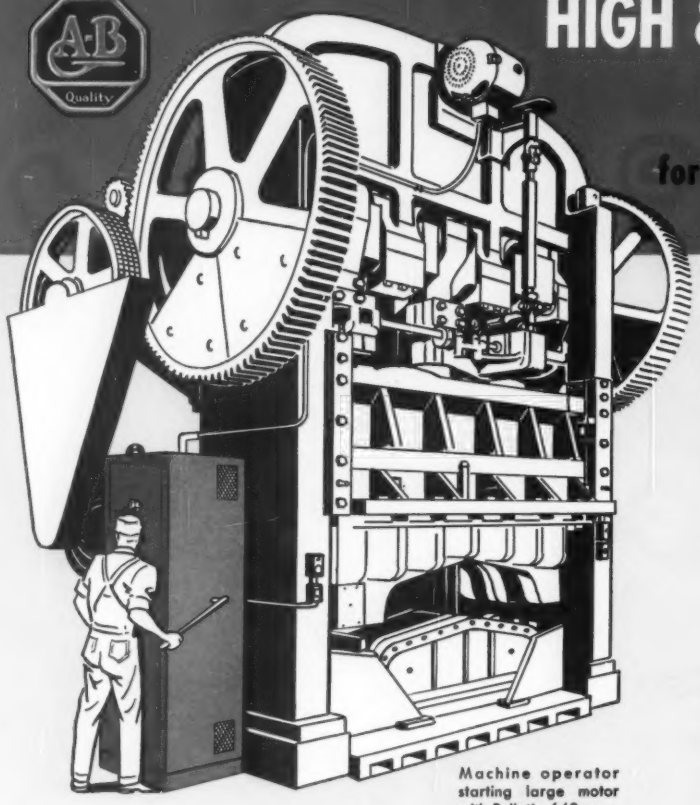
Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wisconsin

In Canada—Allen-Bradley Canada Ltd.
Galt, Ont.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

P-55-MR

HIGH & LOW VOLTAGE STARTERS for BIG MOTORS



Machine operator starting large motor with Bulletin 640 manual velvet smooth resistance starter. Starting jolts are eliminated.

BIG STARTERS for big motors . . . for 220-440-550 volts . . . for 2000 to 2500 volts . . . and for 2501 to 4600 volts . . . are catalog listed units in the Allen-Bradley line. Illustrated below is a limited variety of starters for squirrel cage, wound-rotor, and synchronous motors. Starters for manual or automatic operation are available. Starters for 600 volts or less are available in ratings up to 600 hp. High voltage starters are rated up to 1500 hp.

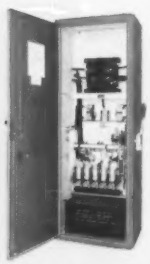
Write for a copy of the Allen-Bradley Handy Catalog in which all varieties of "big starters" are listed. It is also a handy buyer's guide on the latest developments in controls and accessories.

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wisconsin

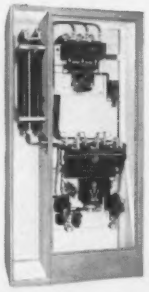
In Canada
Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

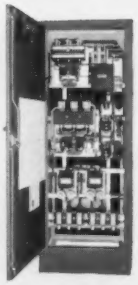
A FEW OF THE BIG STARTERS IN THE ALLEN-BRADLEY LINE



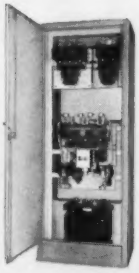
Bulletin 646 manual autotransformer type starter



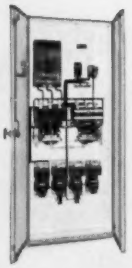
Bulletin 740 automatic reduced voltage motor starter



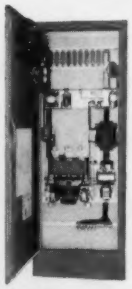
Bulletin 742 automatic starter—velvet smooth acceleration



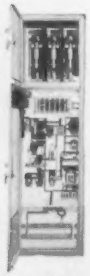
Bulletin 746 automatic autotransformer type starter



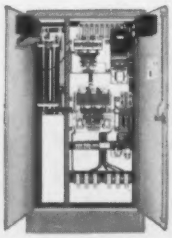
Bulletin 761 automatic wound-rotor motor starter



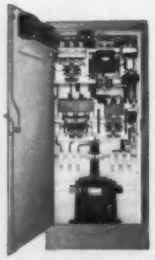
Bulletin 906 across-the-line synchronous motor starter



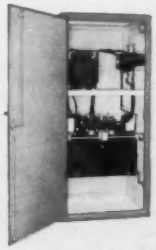
Bulletin 906 high voltage synchronous motor starter



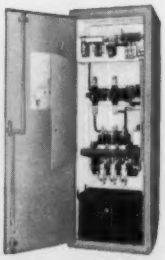
Bulletin 914 reduced voltage synchronous motor starter



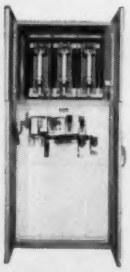
Bulletin 922 low voltage synchronous motor starter



Bulletin 922 high voltage synchronous motor starter



Bulletin 1109 high voltage across-the-line starter



Bulletin 1146 high voltage squirrel-cage motor starter

9-55-MR

If you haven't read this important booklet, your production line may be operating at less than peak efficiency. Your operations may be beating competition with HSS today, but you will likely need carbide tooling to be the leader tomorrow.

Write for your free copy of this important booklet today!

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

it's the greatest advancement in OBI press history

NIAGARA FRONT-TO-BACK

- ***ALL NEW*** rugged, front-to-back crankshaft with huge crankpins
- ***ALL NEW*** compact, fully concealed driving mechanism
- ***ALL NEW*** enclosed, rigidly supported gearing in sealed oil bath
- ***ALL NEW*** electro-pneumatic friction clutch on crankshaft
- ***ALL NEW*** wider spaced, longer, narrower gibs
- ***ALL NEW*** wider, box type slide all within gibbing
- ***ALL NEW*** precision, hardened, longer-wearing gears
- ***ALL NEW*** compact, straight-line, space-saving frame

Hailed as the greatest achievement in modern OBI press design and performance, by over 100,000 spectators who examined this mechanical marvel at the Machine Tool Show, the all-new Niagara Series E, Single Point, Open Back Inclinable Press starts a brand new chapter in press history.

It's years ahead of any OBI ever built. It's an industrial revolution all by itself. No other press, in modern times, embraces so many "All-New" features.

Gone are exposed, overhanging gears, flywheel and other mechanisms. Gone is excessive and damaging crankshaft deflection. Here to stay are: Full support to wide dies. Greater resistance to off-center loading. Accurate alignment of slide, with minimized tendency to cock. Substantially increased die life. Longer lasting, hardened gears. Smoother, safer press performance. Smaller floorspace requirements.

Built in 4 sizes, with shaft diameters from 4½ to 7½ inches and capacities from 75 to 200 tons, the new Series E is available in both standard models and automation models equipped with the most advanced controls and devices for peak production. A complete description of both, with full specifications, is given in new Bulletin 56, sent promptly on request.

SEND FOR NEW BULLETIN . . .

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

DISTRICT OFFICES: Buffalo • Cleveland • Detroit • New York • Philadelphia

Dealers in principal U. S. cities and major foreign countries.

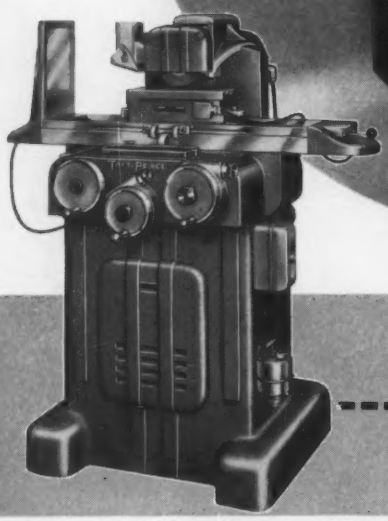
America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work.

CRANKSHAFT-OBI PRESS DESIGN

STANDARD DESIGN
For General Purpose Production

MODIFIED DESIGN
For Automation Lines

So Flat they Wring *without lapping*



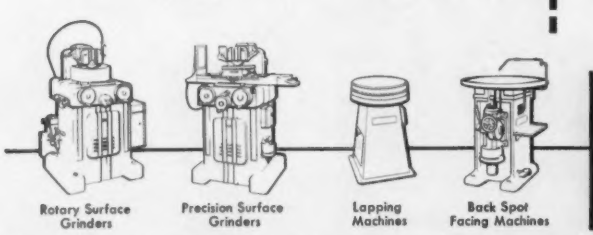
Ground on a Taft-Peirce No. 1 SURFACE GRINDER

Hard to believe but true, this Taft-Peirce No. 1 Surface Grinder, with verniers, produces surfaces of an accuracy, flatness, and finish formerly considered difficult or impossible to achieve. Experienced operators frequently can grind to .00005″, with surfaces so accurate they wring . . . so smooth they seal without lapping.

and a Taft-Peirce 6″ ROTARY GRINDER

Developed for our own shop, T-P 6″ Rotary Grinders make fussy precision work easier and faster than ever before. Vernier feed provides .0001″ vertical settings . . . frequently permits grinding surfaces so smooth they seal without lapping. Tilting Wheelhead tips 30 degrees below center. Superpower magnetic chuck turns through 15 degree angle.

For the complete story on these items and many more, send for your copy of the Taft-Peirce Handbook.



Rotary Surface Grinders | Precision Surface Grinders | Lapping Machines | Back Spot Facing Machines

T-P means Top Precision T P

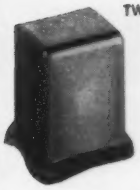
THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

For more information on products advertised, use Inquiry Card, page 239

TWO OPERATIONS
Container of 18 gage 2SO aluminum formed by redrawing a larger cup. Part size: 2½" dia. x 4⅝" deep.

TWO OPERATIONS
Relay Cover of 0.025" 2SO aluminum formed by redrawing a round cup into the final shape. Part size: 1¾" x 2⅛" x 3⅞" deep, with ⅛" corner radius.

ONE OPERATION
Cover of 0.037" deep drawing steel. Size: 1⅝" x 2⅝" x 2⅛" deep, with ¼" corner radius.



TWO OPERATIONS
Cover of 20 gage 2SO aluminum formed by redrawing. Part size: 1⅜" x 1⅞" x 2¼" deep, with 3/32" corner radius.

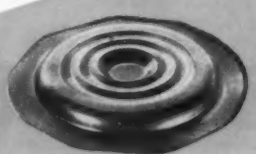
Shown above are typical parts produced by F. & B. Mfg. Co.'s Cincinnati 8" Hydroform. Shown at lower right are other interesting examples of 8" Hydroform work.

Cincinnati 8" Hydroform Brings New Economies To F.&B.

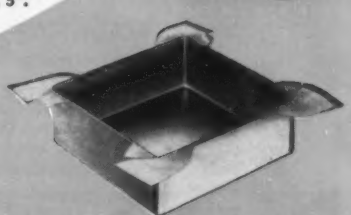
Equipped with the Cincinnati 8" Hydroform shown at right, F. & B. Mfg. Co., Chicago, Illinois, is producing deep drawn parts at costs substantially lower than previously possible using conventional presses. Manufacturers of *Filco* Automotive Ignition Equipment, and contract suppliers of drawn parts, F. & B. gives credit to the 8" Hydroform for greatly increasing the versatility and *economy* of their production. Now, formerly difficult short-run jobs are handled with ease, and experimental work is readily completed—all with exceptional time and tool cost savings.

If you do deep drawing, or can convert a portion of your component part production to drawn shapes, you can receive the same benefits from Hydroforming now enjoyed by F. & B. Let a Cincinnati Milling field engineer give you full details. New Bulletin M-1908—completely revised—gives a detailed description of Hydroforming and specifications of the 8", 12", 19", 23", 26" and 32" machine sizes. Write for your copy.

8" HYDROFORM
Max. draw depth, 5".



ONE OPERATION
Diaphragm of 0.005" stainless steel, 1⅝" dia. Extremely close tolerances held on part contours.

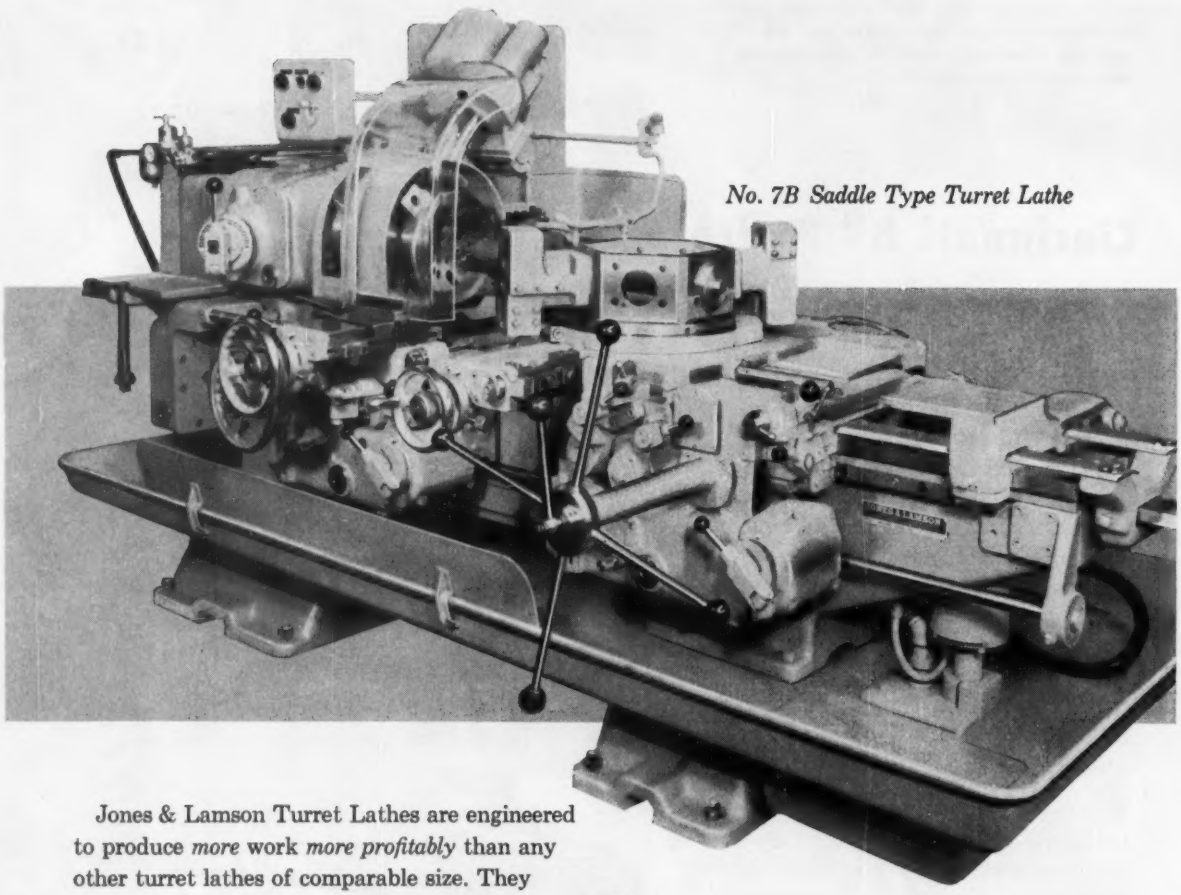


ONE OPERATION
Box of 0.010" 2S full hard aluminum. Part size: 2" square x ⅝" deep, with 0.030" corner radius.

CINCINNATI **Hydroform**

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

Engineered for Precision... Powered for Production...



No. 7B Saddle Type Turret Lathe

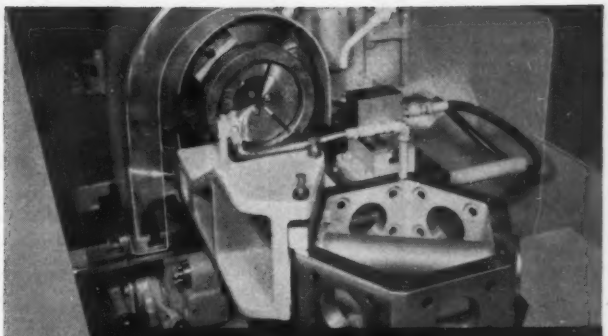
Jones & Lamson Turret Lathes are engineered to produce *more* work *more profitably* than any other turret lathes of comparable size. They have the rugged, rigid construction that makes possible greater accuracy and the use of Hi-Velocity turning; and they incorporate many superior features that assure PRODUCTIVE CAPACITY unmatched in its class. Adequate spindle speeds and horsepower insure the proper use of carbide cutting tools at surface speeds of 650-750 feet per minute.

J&L® JONES & LAMSON MACHINE COMPANY

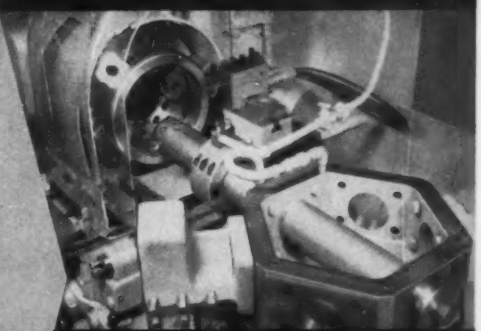
Jones & Lamson offers you a choice of methods for acquiring modern, profit-producing J & L equipment. In addition to outright purchase, J & L makes available several different "Pay-From-Productivity" plans at interest rates of 3¼% and lower (add-on), and a broad variety of lease plans.

Send today for complete details on J & L's machines, methods and Procurement Plans. Simply fill in the coupon, clip it to your letterhead and mail.

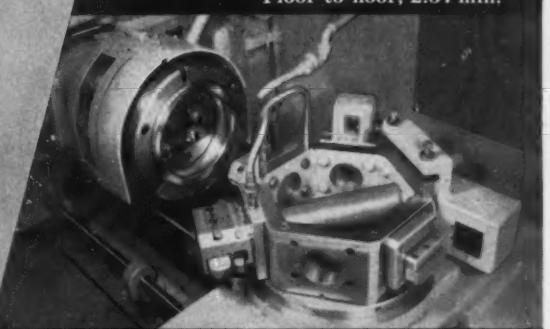
and capable of doing jobs like this...



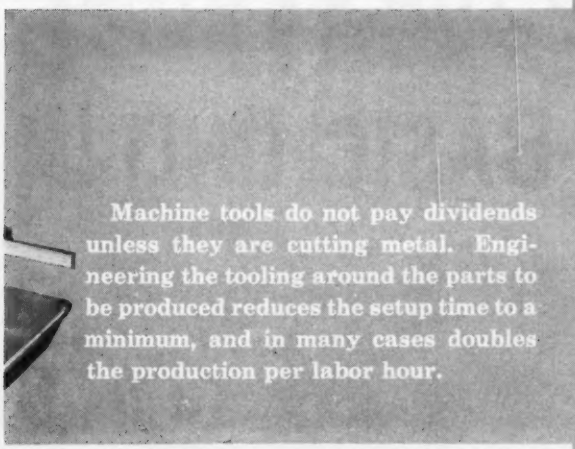
First Operation: One tool mounted on the Hex Turret turns the O.D. while a tool mounted on the rear of the cross slide faces one end. At the end of the facing cut, the radius on the O.D. is formed.
Floor-to-floor, 1.94 min.



Second Operation: Location is taken from the two previous finished surfaces. Boring and I.D. chamfering are performed by using tools mounted on the Hex Turret while facing and forming of the O.D. are finished by tools mounted on the rear of the cross slide.
Floor-to-floor, 2.57 min.



Third Operation: Special wrap-around jaws mounted on a power operated three-jaw scroll chuck are used for holding the finish turned ring when grooving. The groove is formed by a radius tool held in a bar mounted on the Hex Turret (this applies to internal or external straight or taper races). I.D. is also chamfered in this operation.
Floor-to-floor, 1.67 min.



Machine tools do not pay dividends unless they are cutting metal. Engineering the tooling around the parts to be produced reduces the setup time to a minimum, and in many cases doubles the production per labor hour.

In this case high production methods of tooling for automatic lathes were simplified and applied to three 7B J&L Universal Saddle Type Turret Lathes. Inner and Outer Ball Bearing Races and Roller Bearing Races are produced on the same machines. Setup time from one lot to the next does not exceed fifteen to twenty minutes per machine.

MACHINE TOOL DIVISION

UNIVERSAL TURRET LATHES • FAY AUTOMATIC LATHES • AUTOMATIC DOUBLE-END MILLING & CENTERING MACHINES • AUTOMATIC THREAD & FORM GRINDERS • OPTICAL COMPARATORS AUTOMATIC OPENING THREADING DIES & CHASERS

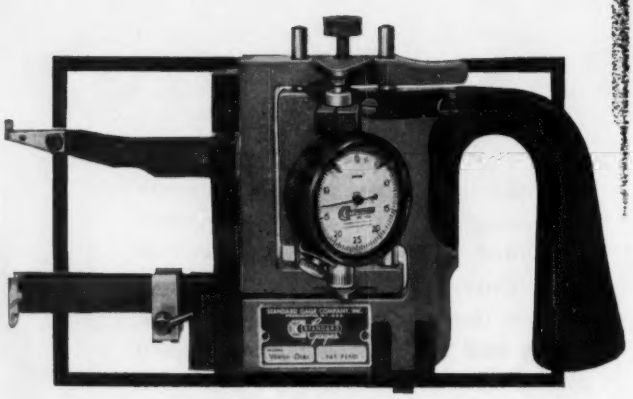
512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

Jones & Lamson Machine Company
512 Clinton St., Dept. 710, Springfield, Vt., U. S. A.
Please send me the J & L Machine Tool Replacement Information Kit.
*Name*_____
*Title*_____

MEASURE I. D. GROOVES

FROM .375" TO 8" AND MORE

WITH THE SAME BASIC UNIT!



TYPE shown above for grooves down to .375".

THREE SIZES of type shown at right measure from .625" to 8" and more. These are equipped with adjustable backstops, which automatically locate the groove for more rapid checking. Steel or tungsten carbide tips are removable and can be furnished to various specifications.

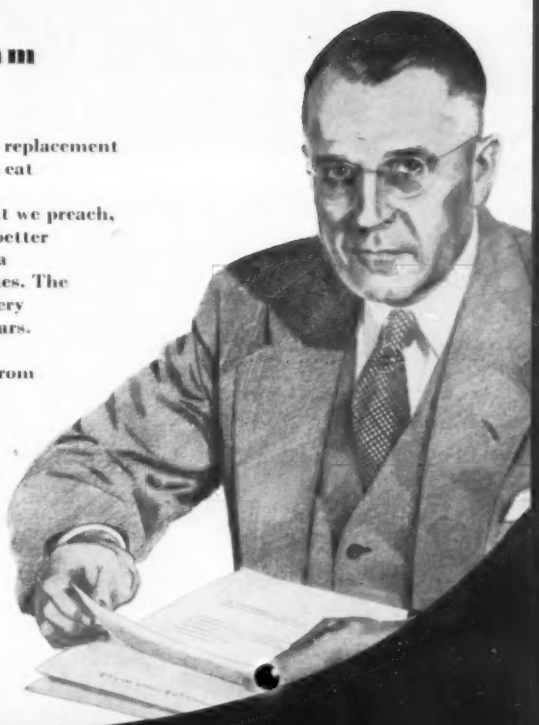
THESE INTERNAL groove gages are built around Standard's recently developed Versa-Dial, a multi-purpose dial unit capable of a large variety of both internal and external gaging applications, including threads, gears, counterbores, shallow diameters, etc. Write for details.

STANDARD GAGE COMPANY, INC.

52 PARKER AVENUE STANDARD® **POUGHKEEPSIE, N. Y.**

For more information on products advertised, use Inquiry Card, page 247

Why the Rockford Machine Tool Co. Uses An Equipment Replacement Program



"It is as natural for the machine tool builder to urge replacement of obsolete equipment, as it is for the grocer to urge you to eat vitamin packed food. He knows you will be a lot healthier.

"Here at Rockford Machine Tool Co. we practice what we preach, because we know it is best for us. Our constant search for better methods, cost reduction, and improved quality has led us into a continuous program of replacement of obsolete machines. The fact that it costs money to use obsolete or deteriorated machinery is not new. Progressive companies have known this for years. Under the accelerated depreciation allowances of the new tax law, equipment replacement becomes more attractive from the financial standpoint.

"Whether you use the MAPI formula, or follow a common-sense plan of your own, a replacement program will help your production. Better start now — your competitor probably has."

H. B. Newton, President
Rockford Machine Tool Co.

Keep gathering metal-working production ideas . . .
be well informed when you replace machinery . . .

How other manufacturers are using equipment replacement programs

. . . is described in this new booklet prepared by the members of the Rockford Insert Group. It contains up-to-date information from some of America's foremost industrial plants. If you'd like a copy, write to any one of the companies in the Rockford Insert Group.

Rockford Insert Group

November, 1955

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FROM .375" TO 8" AND MORE

WITH THE SAME BASIC UNIT!

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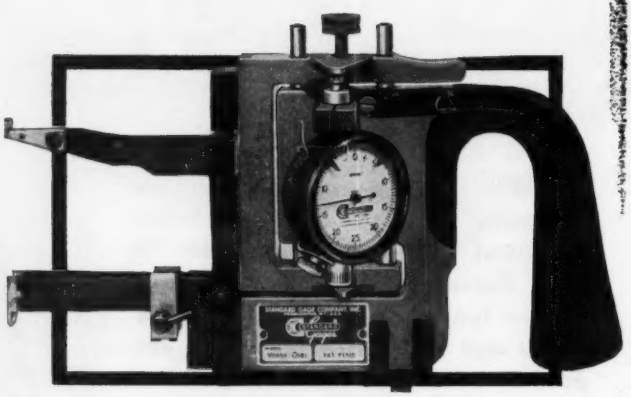

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STANDARD GAGE COMPANY, INC.

52 PARKER AVENUE — STANDARD — POUGHKEEPSIE, N. Y.

For more information on products advertised, use Inquiry Card, page 247

Why the Rockford Machine Tool Co. Uses An Equipment Replacement Program

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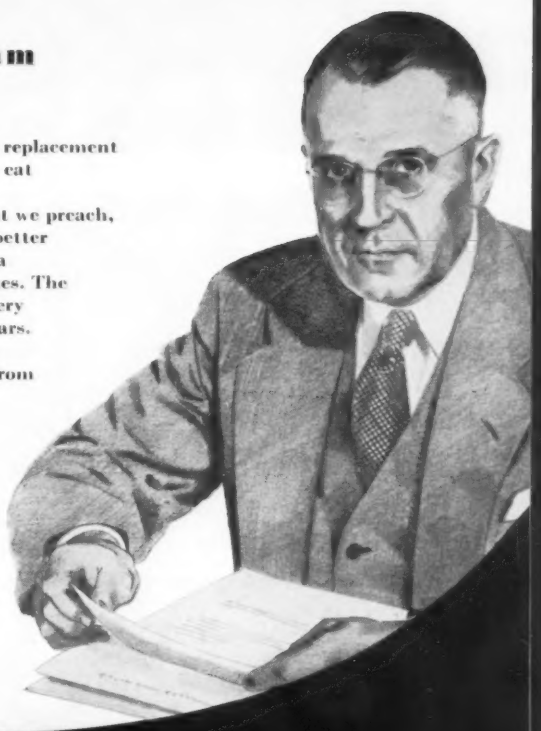

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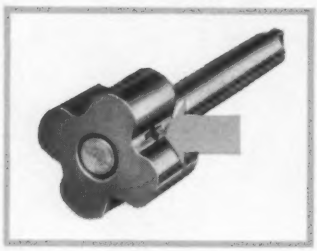
Rockford Insert Group

November, 1955

REHNBERG-JACOBSON

Shows the way to...

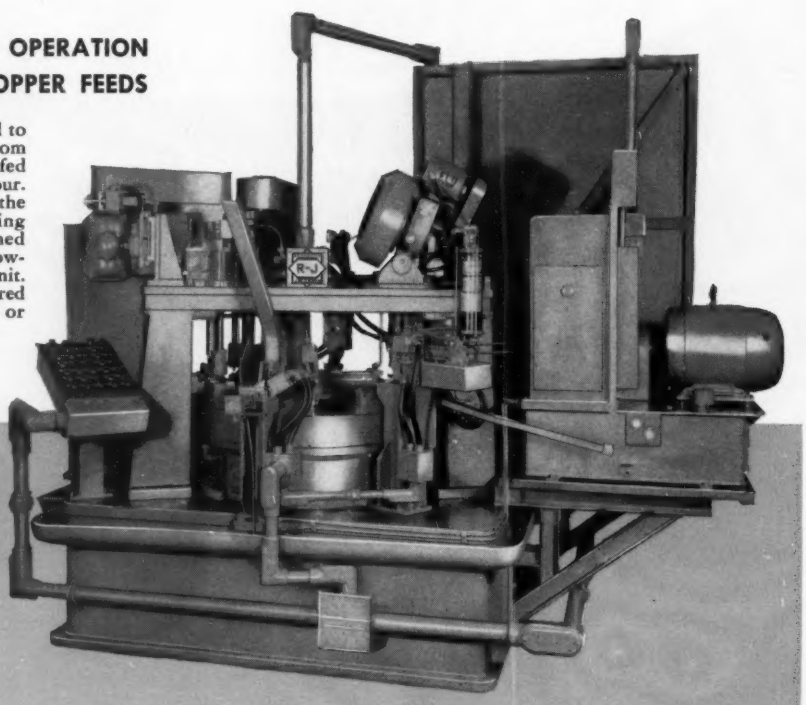
ASSEMBLE, DRILL, REAM, PIN and STAKE
PUMP ROTOR and SHAFT



The machine shown below is an example of the *versatility* of Rehnberg-Jacobson design and manufacturing ability. The principal function of this machine is *automatic assembly* of several pieces, plus two simple machining operations that go with the job. The rotor and shaft are pressed together, a bottom hole is drilled in the assembly and then reamed and blown to remove chips, a pin is pressed in, a staking operation is performed, and a final shaving cut cleans the burrs off the staking. The machine is fully automatic, requiring only loading of parts into magazines and hopper. Production is conservatively rated at 150 assemblies per hour.

FULLY AUTOMATIC OPERATION
MAGAZINE and HOPPER FEEDS

The rotors and shafts feed to the first assembly station from gravity magazines. Pins are fed from a hopper at station four. Both assembly operations, the staking stroke, and the shaving operation are all performed by hydraulic cylinders powered by a self-contained unit. Completed pieces are delivered by a chute to a tote box or conveyor.



SELF-CONTAINED
R-J UNITS USED

The drilling and reaming operations at stations two and three are performed by R-J No. 45 Drill Units with cam feed and special tooling. Fixtures are mounted on an R-J 6-station Automatic Index Unit.

Designers and Builders of Special Machinery

REHNBERG-JACOBSON MANUFACTURING COMPANY

2135 KISHWAUKEE ST.

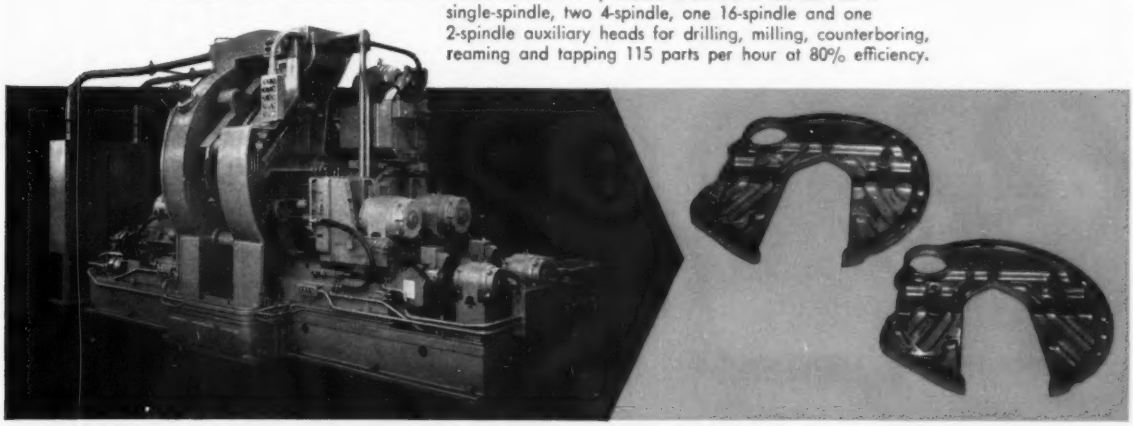
ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

BARNESDRIL

UNIT MACHINES
GUARANTEE
CONTROLLED PRODUCTION-RATE

BARNESDRIL SPECIAL UNIT-MACHINE with 6-station rotary index. Machine is tooled with 2 single-spindle, two 4-spindle, one 16-spindle and one 2-spindle auxiliary heads for drilling, milling, counterboring, reaming and tapping 115 parts per hour at 80% efficiency.



BARNESDRIL SPECIAL DOUBLE-END TRUNNION MACHINE for drilling, chamfering and tapping holes in aluminum housing adaptor plate at the rate of 70 parts per hour, 80% efficiency. Tooling includes two 16-spindle, one 11-spindle and one 10-spindle auxiliary head, and one 6-spindle and one 13-spindle lead screw tapping units.

send for complete catalog, bulletin 1504

These are Typical Examples —
of BarnesdriL Engineering Skill in combining a specified number of production operations into a single automatic cycle, to produce a required rate of production.
A wide range of work operations is available through the flexibility of rotary index, lateral index, drum index or work transfer mechanisms. Units adapt themselves to vertical, horizontal or angular arrangement. Call your BarnesdriL representative for recommendations on your production-rate problems.

HOLE BARNESDRIL FINISHING

BARNES DRILL CO.

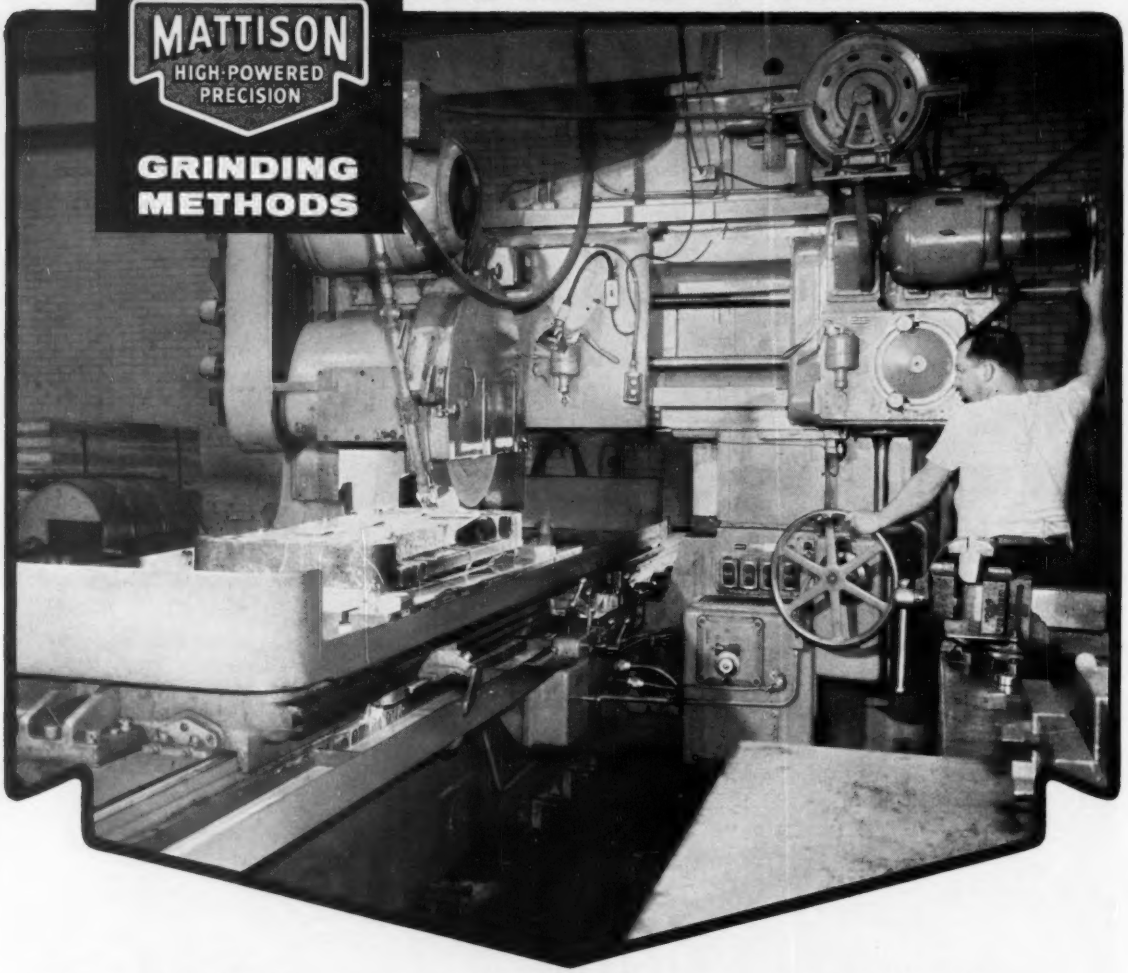
820 CHESTNUT STREET • ROCKFORD, ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 9—H-C STEEL BLANKING DIES

MATTISON
HIGH-POWERED
PRECISION

GRINDING METHODS



Accuracy upgraded from .006 in. to .0003 in. sharpening large blanking dies on the "Plano"

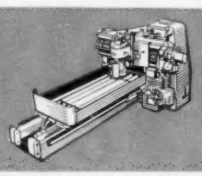
Operators set up male blanking die on Plano Grinder where it is ground with speed and precision.

Improved precision, rather than high production, was the primary goal of this user of a Mattison Plano Horizontal Spindle Surface Grinder. Yet, experience proved it possible to achieve both. One precision job ground on the machine is a male blanking die of high carbon, high chrome Ontario steel. Accuracy is maintained to .0003 in. compared to .006 in., which was the closest tolerance obtained on the previous equipment. Floor-to-floor time for grinding the die has been reduced from 3 hours to 1½ hours on the Plano. Improved finish is another notable benefit gained.

The Plano Grinder features massive, rugged construction and high horsepower characteristic of the entire Mattison line. It is unexcelled for grinding flat and "V" ways; long, narrow work; large, flat work; surface tables; plates; dies; jigs; and similar work.

Write for Bulletin No. 345 which describes this versatile, powerful grinder.

IF IT'S A FLAT SURFACE
THERE IS A MATTISON
TO GRIND IT



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 10—TRANSFER MACHINE PARTS

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

"High Power" increases production 100%

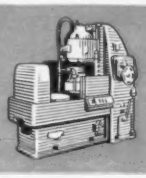
. . . grinding hardened steel plates

Here's how Mattison's high horsepower, integral base and column assembly, and long, wide head slide ways increase production and accuracy when grinding machine tool components. One manufacturer uses a Mattison No. 36 Rotary Surface Grinder to grind subplates for a transfer machine built for an automobile maker. This plate, of 1019 steel and 50-60 Rockwell C hardness, is 19½ in. square with four milled pads on its base side. A light pass is made over the pads, after which the plate is reversed and the flat surface ground. Stock removal is .125 in., the plate must be flat within .002 in., and parallelism is held to within .001 in. The user reports that it would take 100 per cent longer to grind these subplates on a competitive make of grinder. Bulletin No. 146 describes the Mattison Rotary Surface Grinder line.

Send your parts to the Mattison Methods Laboratory for free sample grind and production estimate developed under production conditions.

Stock removal from these transfer machine subplates is .125, parallelism must be within .001 in.

MATTISON
MACHINE WORKS
ROCKFORD, ILL. U.S.A.

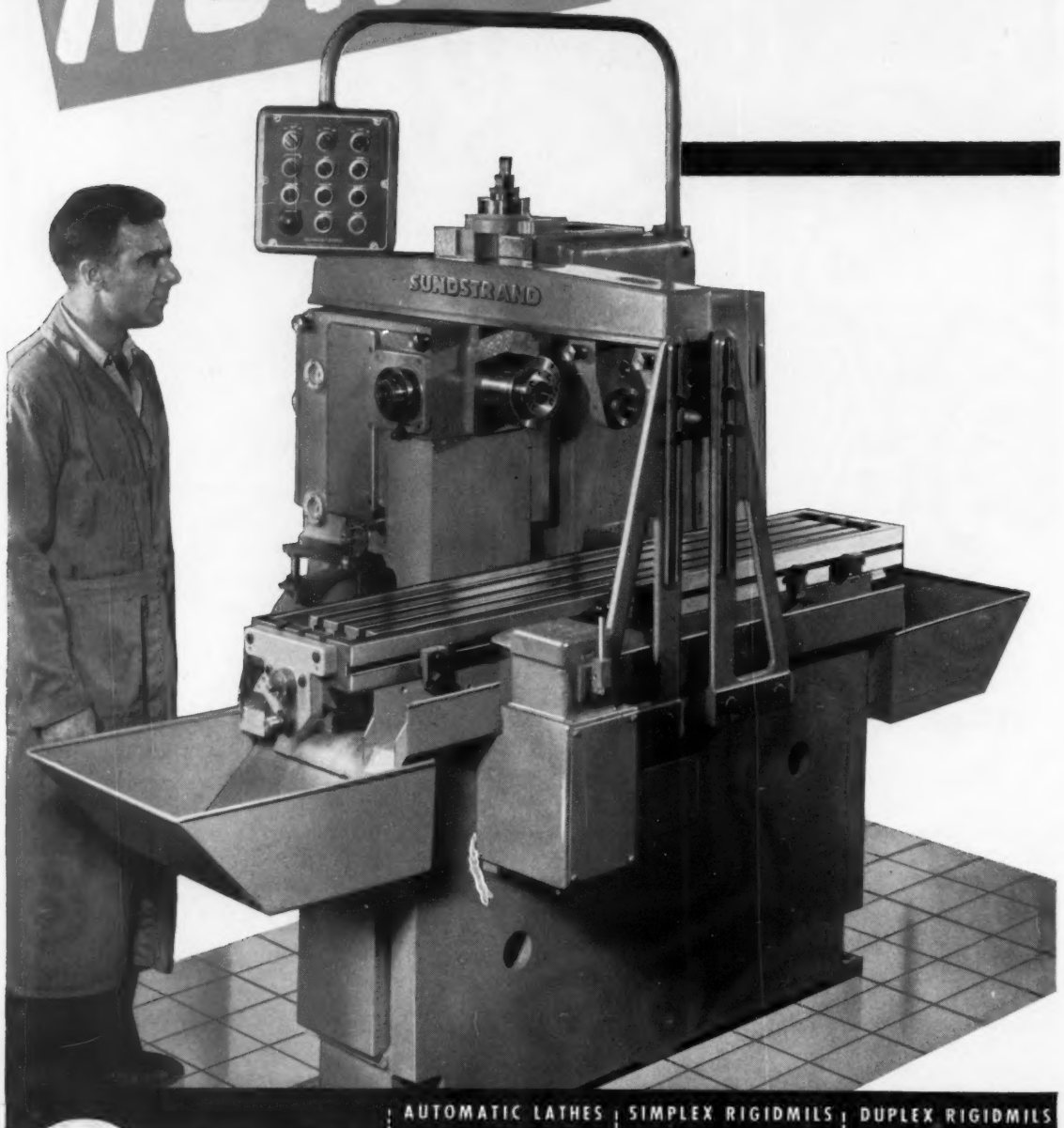


HIGH-POWERED
PRECISION
SURFACE GRINDERS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

NEW!

SUNDSTRAND C-1 RIGIDMIL

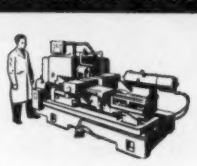


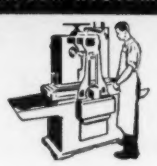
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

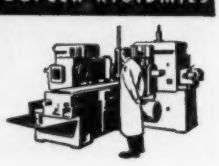
SUNDSTRAND

50 YEARS OF *"Engineered Production" Service**

*REG. U.S. PAT. OFF.



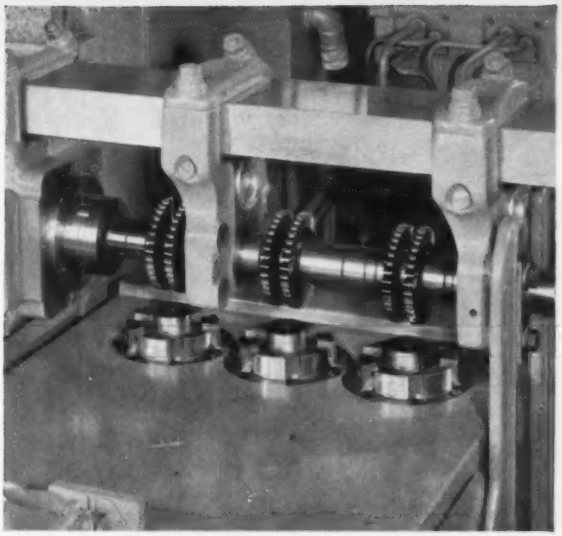




MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

a 5 H. P. Machine for:

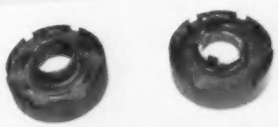
1. Production Milling
2. Easy Tooling of many jobs
3. Simplified Hydraulic Clamping



Installation above shows Rigidmil equipped with hydraulically operated fixture for holding three transmission parts.

This new Sundstrand Rigidmil has hydraulic feed to the 10½" x 58" table and a maximum stroke of 24 inches. The feed range is from 1" to 100" per minute with rapid traverse of 350 inches per minute.

A feature of the machine is the ease with which the circuit can be arranged for hydraulic clamping. The table feed circuit for the standard machine is arranged so that hydraulic clamping can be added without changing circuit. Spindle head is self contained unit with independent motor drive of 5 H.P. Standard speed range is from 50 to 1500 R.P.M. Speed changes are by pick-off gears with four changes possible with each set of two change gears. Head is carried on a movable column so that the spindle nose can be set from 5" min. to 11¾" max. Machine is available in either a vertical or duplex type as well as the simplex type shown.



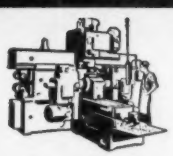
A TYPICAL EXAMPLE

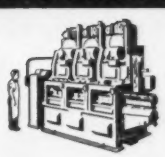
By using the table feed pump as power source, only directional valving was required to provide hydraulic fixture clamping and indexing to this Rigidmil installation. Three pairs of straddle milling cutters are used to mill lugs on transmission part.

For Additional Information

Send part prints, production requirements and amount of stock removal. We will be pleased to furnish you with a preliminary analysis. There is no obligation for this service.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





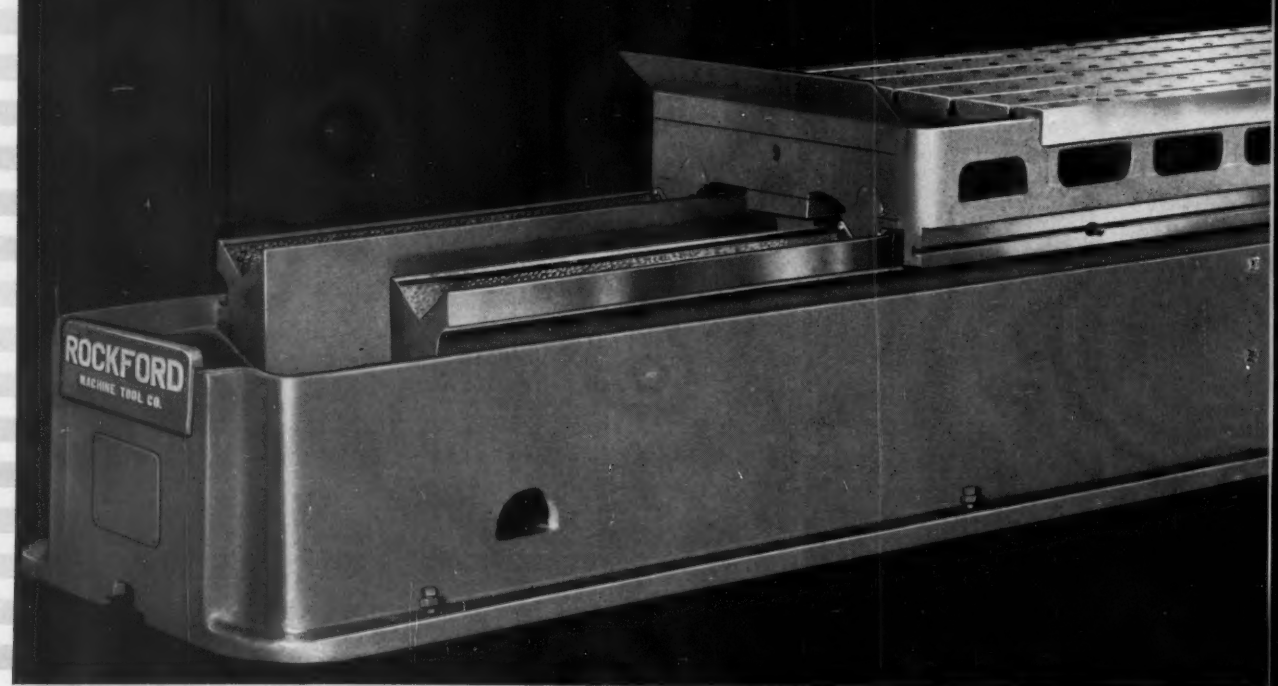
SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

hydraulic

power and speed

The big line of modern Rockford Hydraulic Planers has everything it takes for finer, faster, lower-cost planing. With the exclusive new Triple Circuit, and push-button controls, cutting speeds and forces are now instantly available to most economically machine every type of metal—from free cutting materials to the toughest steels. For the complete story on how to obtain greater profits in modern planing with the unique production advantages of Rockford Hydraulic Planers . . . ask a Rockford Machine Tool Co. representative . . . or write us direct.



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

Hy-Draulic

Reg. U.S. Pat. Off.

ROCKFORD MACHINE TOOL CO.

2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

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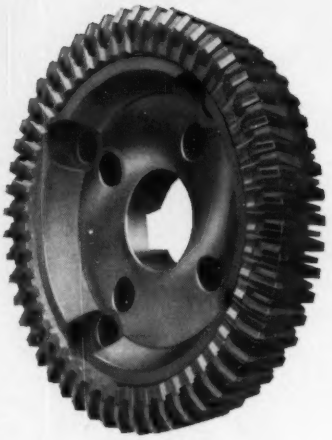
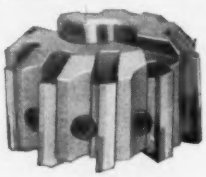
INGERSOLL
CARBIDE CUTTERS

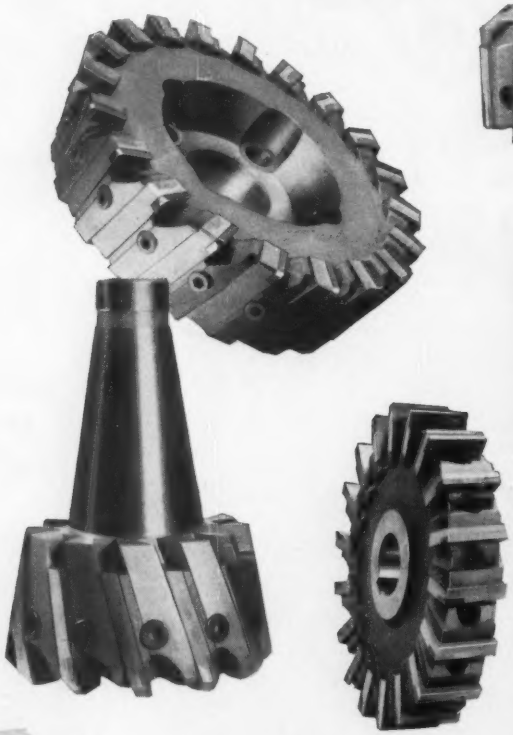
Have you seen what they can do?

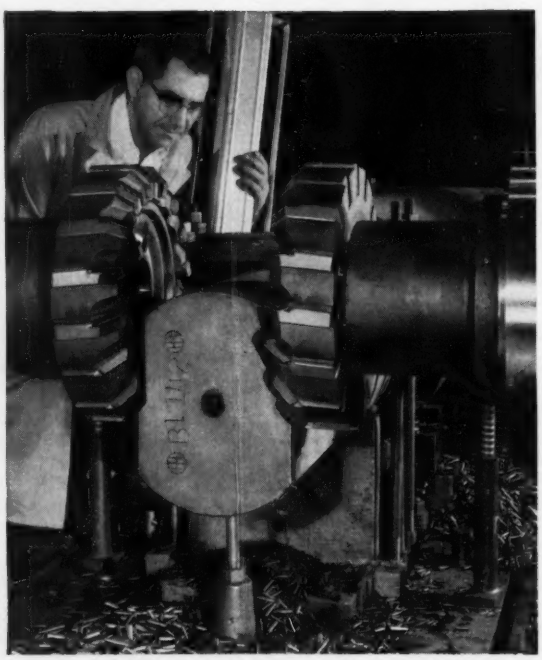


Difficult and unusual operations such as milling the ends of the rolling mill roll shown below help Ingersoll to design carbide cutters for large increases in production.

A leader in carbide research, Ingersoll has developed new cutting techniques using improved grades of carbide. Ingersoll inserted blade cutting tools, for all kinds of materials, will give you increased feed rates and longer blade life. Our cutter engineers are available to show you how Ingersoll carbide cutters can multiply production on your particular milling and boring machines.







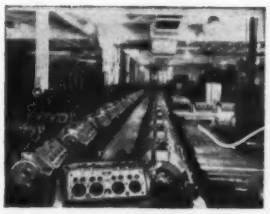
WRITE FOR CATALOG 66B

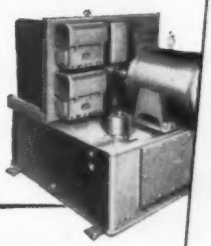
Write for Cutter Catalog 66B, describing Ingersoll inserted blade face mills, end mills, helical slab mills, side mills, arbor cutters and boring heads.

THE INGERSOLL MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS, U.S.A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES
ORIGINATORS OF SHEAR CLEAR CUTTERS

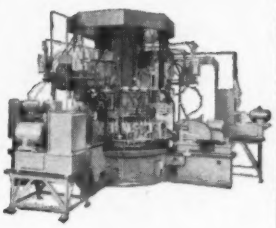
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



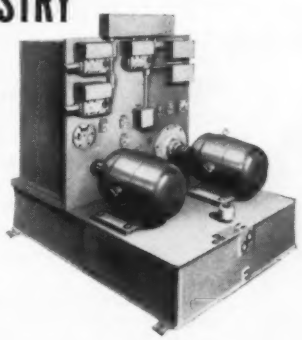


Memo From
John S. Barnes Corporation

Here is the story of a new concept in hydraulic power transmission and control. Maintenance is simplified to cut costs substantially. Send for your copy today!

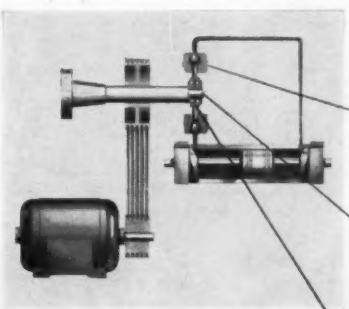


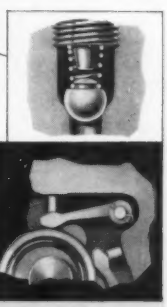
BARNES hydraulics in mass production INDUSTRY

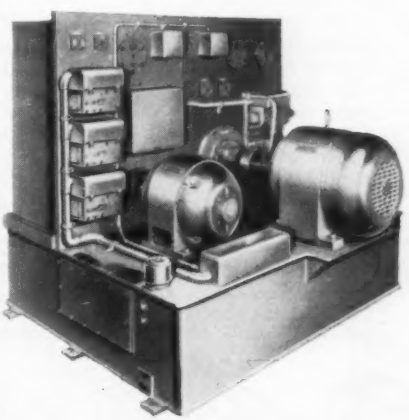


alone

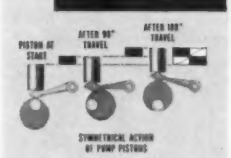
BARNES closed fluid circuit and drive







The Barnes Closed Fluid Circuit consists of a rotary supporting means; a variable displacement pumping arrangement synchronously driven from the rotary means; and a driving arrangement, including means for connecting and disconnecting the rotation of the rotary means, which causes the displacement pump to operate automatically and synchronously with the rotary supporting means.



JOHN S. BARNES CORPORATION / ROCKFORD, ILLINOIS

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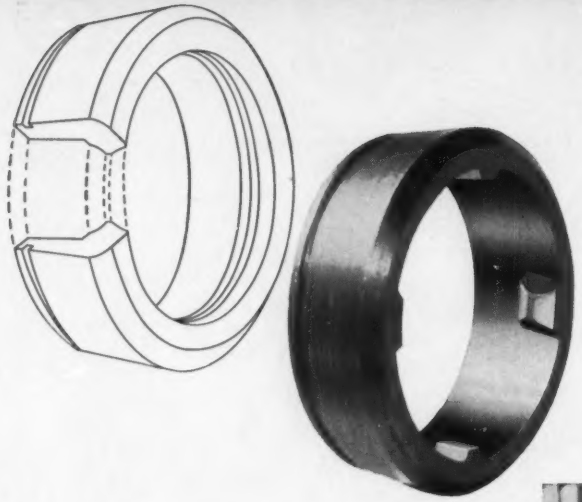
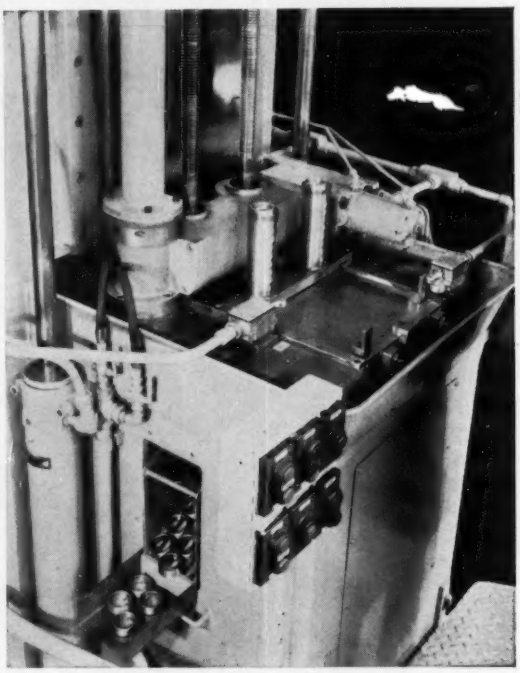
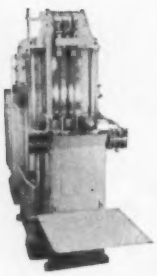
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



I. D. and four inverted helical splines BROACHED the American way

. . . 300 parts per hour





MACHINE
American two-station, pull-down broaching machine with spiral drive unit.

FIXTURES
American hydraulic slide unit with feed tubes and automatic clamping and ejection mechanism.

BROACHES
American combination round-and-spline broaches with helical spline teeth.

American engineering made this broaching operation fast, automatic and economical.

The finished inside diameter and four inverted helical splines are broached, in this automotive synchronizer ring, two at a time . . . 300 per hour.

American special combination round and spiral spline broaches are used to cut the splines concentric with the I.D.

The broach shanks are threaded through the rings, before they are clamped, in order to start the broaches through the parts, concentric with the holes.

Feed tubes are here shown as manually loaded but are readily adapted to automation. Parts are fed and ejected by automatic hydraulic slides.

You may have parts that can be produced at significantly lower cost by broaching them the American way. Send part print or sample . . . American engineers will make a recommendation you'll find valuable.

American Catalog 450 is a complete broaching manual . . . write for it today.

AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

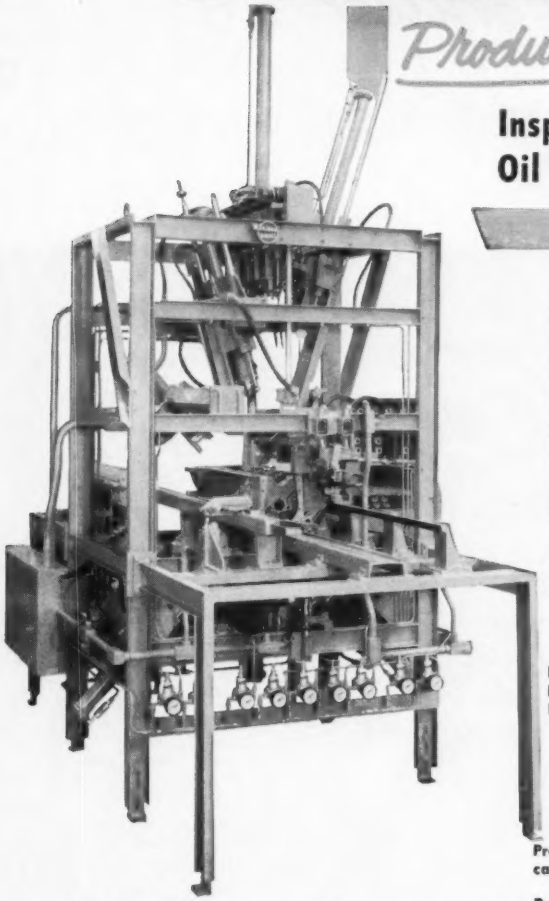
See American First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

SPECIAL

W. F. & JOHN BARNES MACHINE *Solves Production Line Problem*

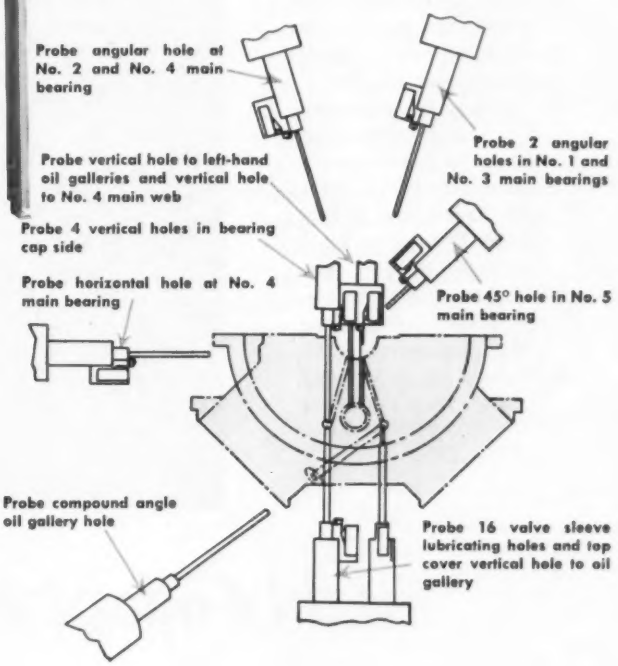
Inspects 36 Cylinder Block Oil Holes Automatically



▶ Drawing illustrates how vertical, angular, and horizontal air cylinders automatically probe 36 cylinder block oil holes. Collapsing-type probes indicate the exact obstructed oil hole on a master control panel.

● This W. F. & John Barnes Special Automatic Probe Machine, designed and built for a large automobile manufacturer, now test probes 36 cylinder block oil holes for obstructions automatically. The new unit is located in the cylinder block production line just ahead of a bearing cap assembly station. Collapsing-type probes, equipped with microswitches, indicate location of any obstructed holes on a master control panel. Faulty blocks are marked for removal from the Barnes machine and are not allowed to proceed to the next station until the operator clears the master control panel.

This machine is just one of many types designed and built by W. F. & John Barnes to help solve troublesome production problems. Call in a Barnes Process Equipment Engineer today. He'll work with you in developing better cost-cutting methods and equipment.


Probe angular hole at No. 2 and No. 4 main bearing
Probe 2 angular holes in No. 1 and No. 3 main bearings
Probe vertical hole to left-hand oil galleries and vertical hole to No. 4 main web
Probe 4 vertical holes in bearing cap side
Probe horizontal hole at No. 4 main bearing
Probe 45° hole in No. 5 main bearing
Probe compound angle oil gallery hole
Probe 16 valve sleeve lubricating holes and top cover vertical hole to oil gallery

***Write* FOR FREE DATA**

Write today for your copy of "Coordinated Machine Engineering" describing modern machines and mass production techniques.

W. F. & JOHN BARNES

Special Machine Tools | Special Handling Equipment | Special Electrical Controls

W. F. & JOHN BARNES COMPANY

PROCESS EQUIPMENT DIVISION

416 SOUTH WATER STREET • ROCKFORD, ILLINOIS

BUILDERS OF BETTER MACHINES AND EQUIPMENT SINCE 1872

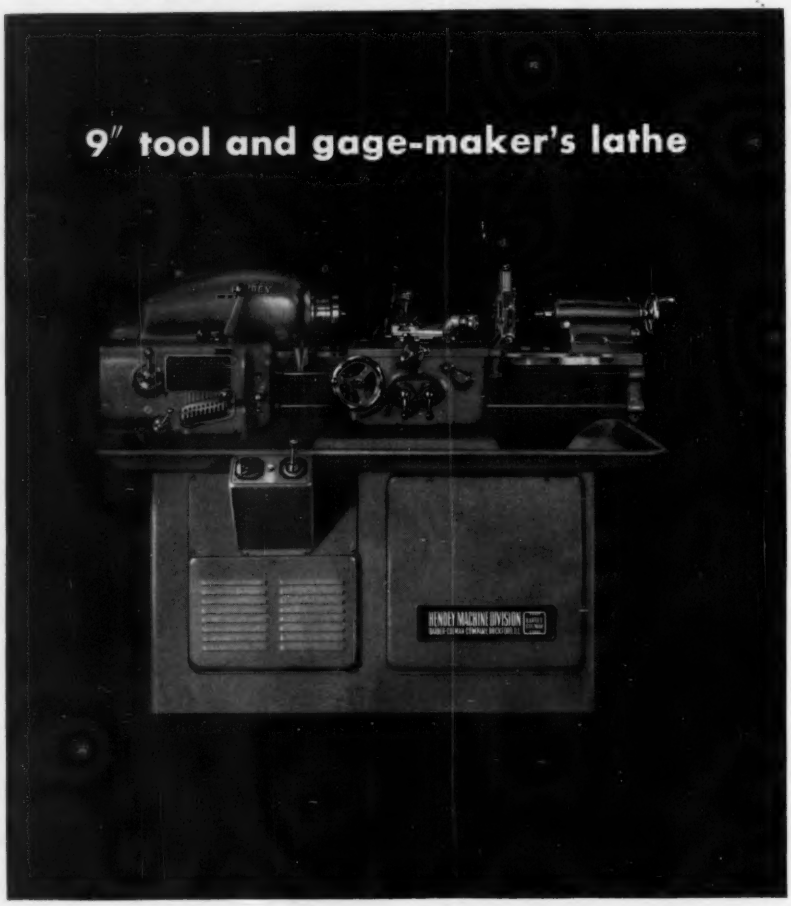
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

see Hendey

for improved accuracy and speed...

The Hendey 9" Tool and Gage — Maker's Lathe provides maximum precision and versatility for toolroom and production use. Some of its features include 24" center distance and 10-1/4" swing, sixty-six thread and feed changes, and an independent lead screw.

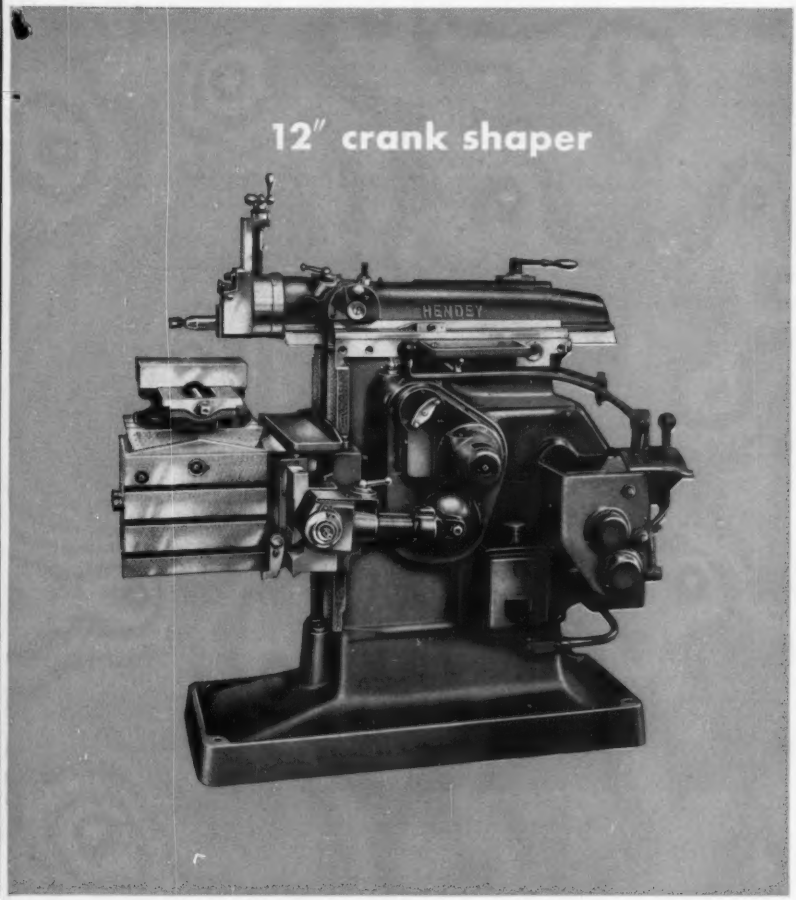
This Hendey lathe has a new magnetic amplifier drive unit for speeds which are infinitely variable and which can be changed smoothly and easily while under load. This type of drive is very simple and requires a minimum of maintenance. Spindle speeds range from 15 RPM to 3000 RPM. Speeds from 15 RPM to 250 RPM are available through back gears. Start — stop, forward — reverse, and spindle speed selection are easily controlled. This machine can also be furnished with an electronic drive unit.



highly adaptable and sensitive

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

greater flexibility in tool room work



The Hendey 12″ Crank Shaper is a high-speed universal machine designed for maximum flexibility in a wide variety of cuts. It is constructed especially for precision work, and speeds up to 200 strokes per minute are available. The vise and table are the finest available on any shaper, allowing the work to be positioned to any desired angle. The universal table will rotate 360° about its axis. The tilting top can be set to 15° on either side of the horizontal position. This machine is also available in 16″ and 20″ sizes.
In addition to the vise and table, standard equipment includes dual mechanical controls, automatic lubrication, power down feed, quick-change swivel head, pre-loaded Timken bearings on the crank gear, and helical teeth on the crank gear and back gear.

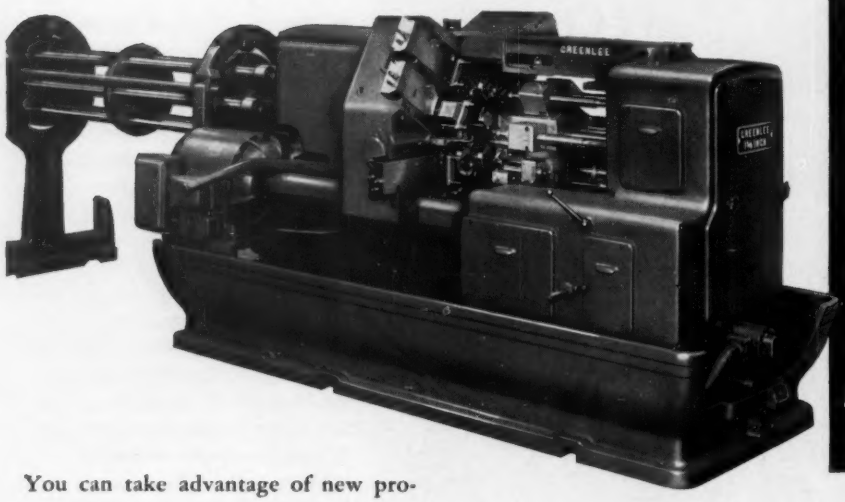
for precision work at high speed

Hendey **machine division**
BARBER-COLMAN COMPANY
115 LOOMIS ST., ROCKFORD, ILLINOIS

BARBER COLMAN

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

now... greater accuracy, faster production



WITH GREENLEE SIX-SPINDLE AUTOMATICS

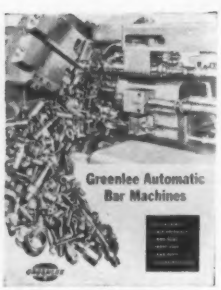
You can take advantage of new production techniques...attain higher levels of efficiency with the improved Greenlee 6-Spindle Bar Automatic. Its advanced design opens the door to some real profit opportunities. • These design improvements are fully described in a catalog recently issued. Let us send you a copy today. Find out how Greenlee Automatic can save time and money in your plant. It will pay you to investigate.

IMPROVED SPINDLE CONSTRUCTION

The spindle has been completely redesigned to assure greater accuracy at higher speeds. True running... the new Greenlee spindle has five widely spaced, preloaded, angular-contact, precision ball bearings. Entire spindle is dynamically balanced for smooth operation. Metallic seals, labyrinth and friction washers with line contact provide maximum heat dissipation.

INCREASED SPEED

Spindle speed range has been increased. Enables you to take full advantage of the top efficiency and peak performance which carbide and high-speed tooling offer. Reduces down-time losses and tool costs.



WRITE FOR CATALOG No. A405

PRODUCTION MACHINERY
GREENLEE

GREENLEE BROS. & CO.
1871 Mason Avenue
Rockford, Illinois

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Here's a Hot Number

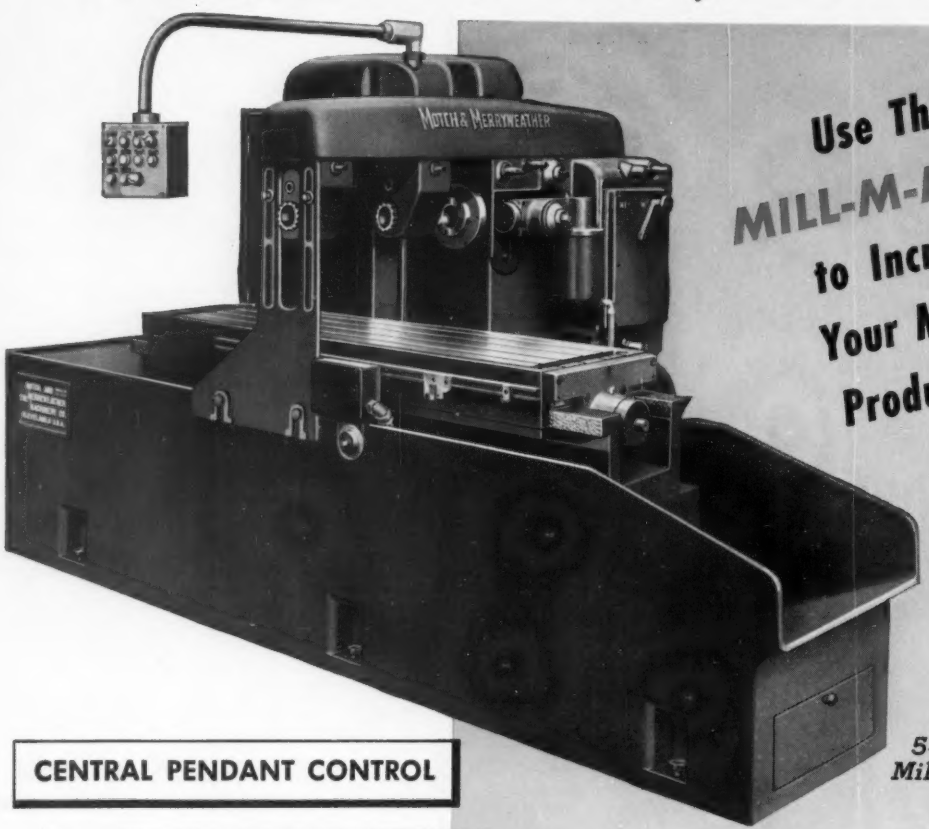
On "Acorn" Dies truly concentric adjustment demands lands with uniform "give".

Spring tempering by precision induction heating (controlled time and temperature) is one more manufacturing refinement that helps make *genuine* "Acorns" the HOTTEST BUY in spring type dies.

"ACORN" means GREENFIELD — GREENFIELD means QUALITY

GREENFIELD TAP and DIE CORPORATION
Greenfield, Massachusetts

Justly Named—the Motch & Merryweather MILL-M-MATIC BED TYPE *Production* MILL



Use This MILL-M-MATIC to Increase Your Milling Production!

Model 5-M-1842 Mill-M-Matic

CENTRAL PENDANT CONTROL

25 H. P. SPINDLE DRIVE

MECHANICAL TABLE FEED

AUTOMATIC TABLE CYCLES

RIGID OVER-ARM

You owe it to your production program to get all the details on this new *heavy duty* series of bed-type Mill-M-Matics. They utilize 25 horsepower through the spindle drive. Electrically controlled movements are mechanical to insure maximum rigidity and effective production with accuracy. . . The new Mill-M-Matic is now offered in a full range of heavy duty sizes by Motch & Merryweather, foremost builder of *traveling head* milling machines.

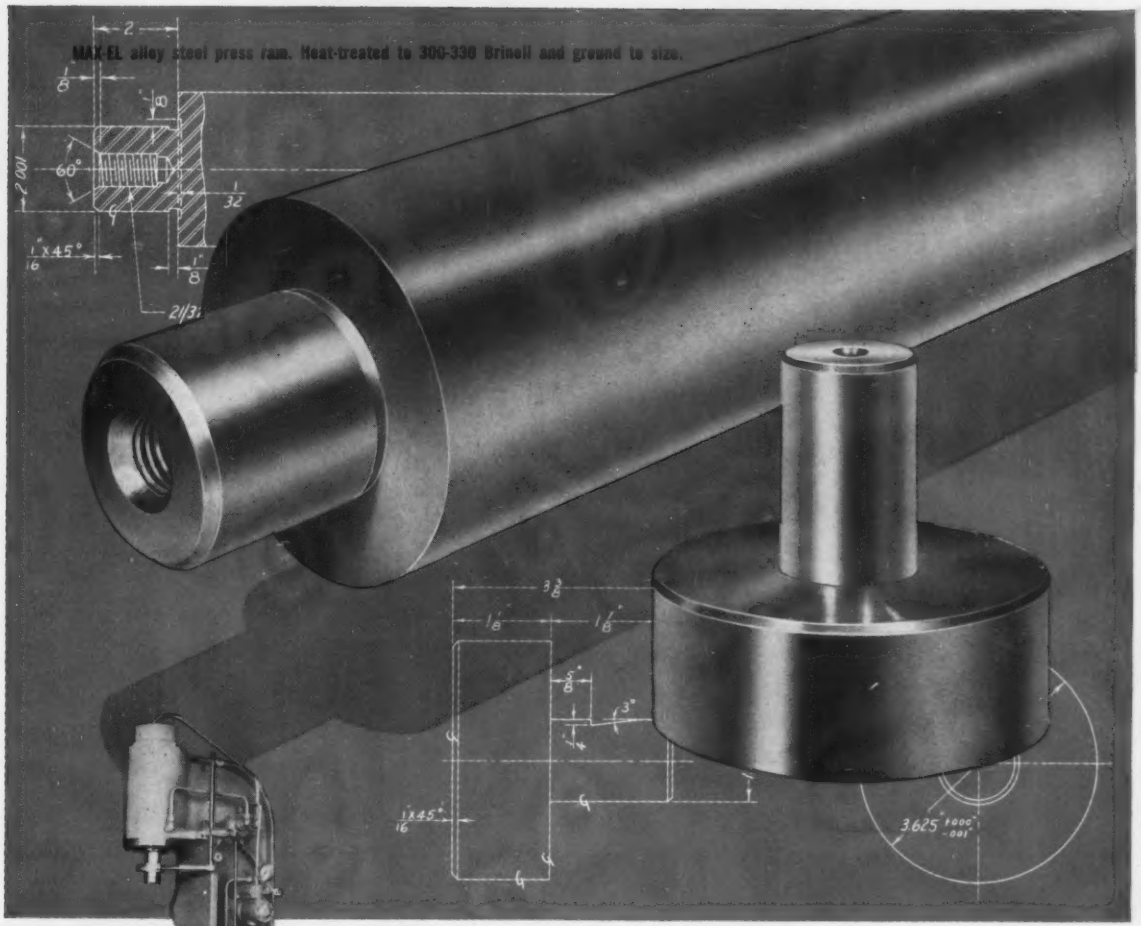
Copyrighted 1955 by The Motch & Merryweather Machinery Co.

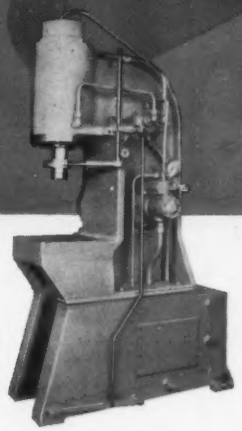
THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

Builders also of Circular Sawing Equipment, Vertical Turning, Automatic and Special Machines





MAX-EL Alloy Steel means no distortion—longer wear in 15-ton hydraulic press ram

To keep this 15-ton press operating day after day for years of dependable service, takes *special* steels. For example, even after thousands of cycles of operation, the ram *must* remain accurately in line with the work table. *It demands a steel that will not distort, set or wear.*

That's why both the ram and ram-plug are made of Crucible MAX-EL alloy steel. In fact, the manufacturer, Greenerd Arbor Press Co., Nashua, N. H., has been a steady user of MAX-EL for many years.

Here's what they have to say—*"We have tried many grades of steel, but we find that MAX-EL 3½ heat-treated in the bar works out better for our application."*

And it probably will for yours, too. So when you have a job calling for a non-deforming alloy steel—one with excellent machinability, high-strength and wear-resistance—try Crucible MAX-EL. It's promptly available from your nearby Crucible warehouse, in the sizes and grades you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

Write for your free copy of this Crucible Publication Catalog listing dozens of helpful booklets and data sheets.

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

HAVE YOU HEARD ABOUT THIS EXTRAORDINARY CLEANER?

It saves money in paint shops!

Oakite Rustripper is an alkaline material that strips paint, pigment residues and phosphate coatings from steel at the same time that it removes rust and oil.

It saves money in plating shops!

Oakite Rustripper removes rust or heat scale from steel at the same time that it removes oil and other soils. It avoids hydrogen embrittlement, damage to machined surfaces and other disadvantages of acid pickling.

FREE

For more information about how Oakite Rustripper eliminates operations in paint shops and plating shops, send for one or both of the illustrated booklets listed in the coupon.

Here's the best shortcut in the field of organic finishing
RUSTRIPPER
Here's the best shortcut in the field of electroplating
RUSTRIPPER

Technical Service Representatives in Principal Cities of U. S. and Canada

•

Export Division Cable Address: Oakite

OAKITE

SCIENCE

OAKITE PRODUCTS, INC.
26 Rector Street, New York 6, N. Y.

Send me free booklet checked below:

☐ "Here's the best shortcut in the field of organic finishing"

☐ "Here's the best shortcut in the field of electroplating"

Name_____

Company_____

Address_____

Paint Shop Men Save Time With New Kind of Stripper

INDIANA: "We formerly stripped TV cabinet rejects in 25 minutes. They came out a brown tarnished color... Had to pickle to remove phosphate coating... Today Oakite Rustripper strips the same cabinet in less than 10 minutes, bringing it out so bright and clean you can't tell it from a new one... Pickle, neutralize and rinses eliminated."

NEW YORK: "It used to take two hours to strip synthetic enamel from these rejects (filing cabinets). Now Rustripper does them in about two minutes. We used to soak conveyor chain links overnight and work hooks for several days. Rustripper does both jobs in two hours and cuts out the wire brushing for rust."

COLORADO: "We were amazed at the results... a perfect job of stripping gray OD enamel, red oxide prime and surface rust from bomb clusters. Oakite Rustripper is the finest material ever used here."

Send for free booklet "*Here's the best shortcut in the field of organic finishing.*" See coupon at left.

Electroplaters Find Profit in Alkaline Derusting

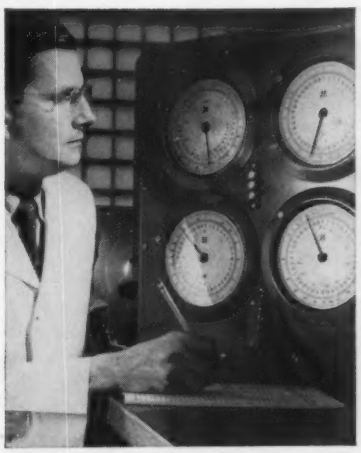
CALIFORNIA: "Formerly sand blasted the heat scale off these aircraft parts. Now the scale is removed in about 30 minutes with a boiling soak in Rustripper at 4 pounds per gallon, rinse, reverse-current clean, rinse; followed by cyanide dip and cadmium plate."

NEW YORK: Removing heavy heat-treat scale, rust and soil from steel aircraft parts before cadmium plating. Also cleaning stainless steel landing gear parts after hardening. Using 3 pounds Oakite Rustripper and 10 ounces sodium cyanide per gallon at 120°F. with periodic reverse current. "An excellent job is being done... Parts are being descaled that we couldn't touch without pickling in muriatic acid... Everyone astounded at life of solution, since this bath is worked very hard and former bath required heavy upkeep... Appears likely to save about $2000 in first year."

CALIFORNIA: "Oakite Rustripper seems to be what hard chrome platers have been waiting for." Used for removing rust from steel shafts after chrome plating, baking, machining, etc., and before oiling. Rust was formally rubbed away with emery paper.

Send for free booklet "*Here's the best shortcut in the field of electroplating.*" See coupon at left.

Why TIMKEN® steel machining bars—tailor-made for you—give such uniform machinability

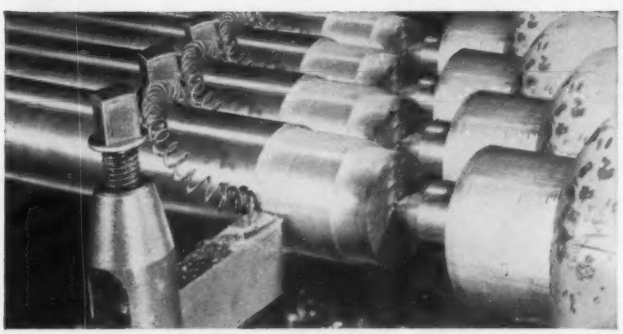


IN JUST 40 SECONDS this direct-reading spectrometer tells the exact chemical composition of a heat of Timken® fine alloy steel. Results are flashed back to the furnace so the melter can keep close control of the analysis. This carefully-controlled chemistry produces uniform composition from heat to heat.

INDIVIDUAL HANDLING of each order enables us to adjust our conditioning procedure to suit your machining requirements. We *tailor-make* the steel for you. Here bars are stamped to identify the heat and ingot they came from. It's one way we limit variation within an order as well as from order to order.

SURFACE DEFECTS are located and removed before your order is rolled to the required bar size. It's one more step we take to make sure Timken steel machining bars give you uniform machinability. With Timken steel, you can turn out a better product and cut your manufacturing costs.

Every bar machines the same



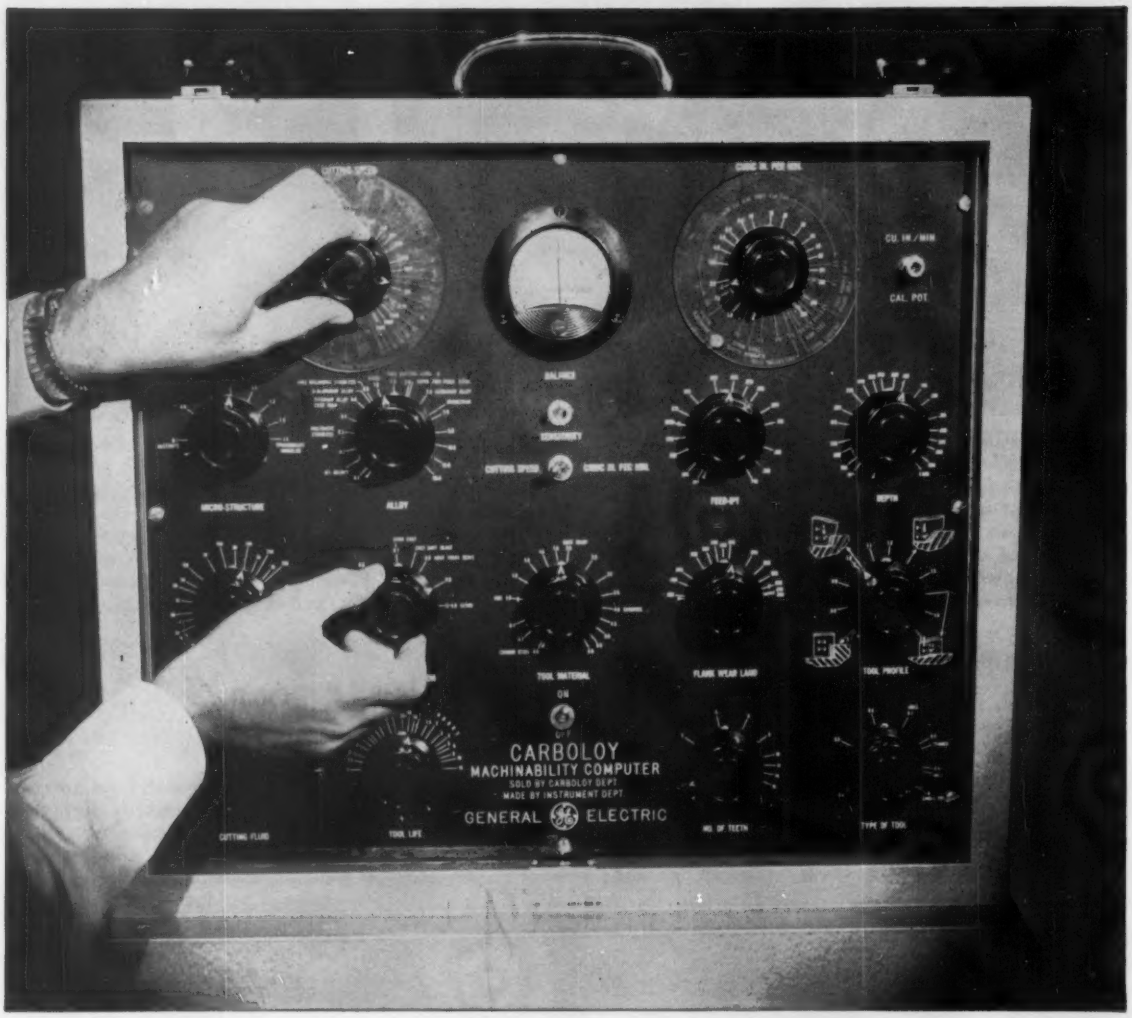
FROM BAR TO BAR, from heat to heat, from order to order, the high quality of Timken alloy steel machining bars is uniform. Timken steel bars machine fast, easily, and with a good surface. Scrap loss is reduced, machining time saved. The quality of your finished product never varies.

Our Technical Staff will be glad to recommend the correct analysis for your machining bar requirements. Write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

Carboloy announces the
CARBOLOY MACHINABILITY



To find an unknown variable like speed, output, or motor horsepower, simply set dials according to known information. Then turn dial of unknown variable until meter (top, center) balances at zero setting. Computer instantly shows what happens when any of the variables listed below are changed.

Computes values for any of these 19 operating variables:

Material Cut:
- Work material
- Microstructure
- Hardness
- Surface condition

Cutting Tool:
- Tool material
- Tool life
- Flank wear land
- Tool profile
- Type of tool
- Number of teeth

Cutting Conditions:
- Cutting fluids
- Feed
- Depth of cut
- Cutting speed
- Motor horsepower
- Cubic inches per minute
- Unit horsepower
- Work diameter
- R.P.M.

COMPUTER

- **New engineering tool solves complex machine setup problems in seconds, instead of hours**
- **Shows how to vary cutting conditions to increase machine, cutting tool, and operator efficiency**

In seconds, the low-cost Carboloy® Machinability Computer calculates the effect of 19 basic machining variables on machine performance, tool life, and output.

In seconds, it shows optimum operating conditions for any metal-cutting job, eliminating wasteful experimental runs.

In seconds, it shows how to improve existing setups by the right variation of operating conditions.

Easy to use

The Carboloy Machinability Computer is easy to operate. Anyone with machining experience can use it after a short familiarization period.

Results are numerical – requiring no further interpretation from the direct-reading dials. Accuracy is assured – based on more than a year's testing on in-plant applications at key General Electric plants.

Handles many jobs

The Carboloy Machinability Computer handles basic information on operating conditions, type and condition of work material, style and material of tools. The computer accurately predicts cubic inches per minute removed, tool life, and required machine horsepower. It shows how changing speed, feed, depth of cut, or tool material will affect these and other variables.

The Computer solves – in seconds – problems that would be otherwise impractical because of the large number of machining variables involved.

The Carboloy Machinability Computer was developed and proved in the field by a team of Carboloy and General Electric engineers, under the direction of Dr. W. W. Gilbert, of G.E.'s Manufacturing Services Division.

The Computer is portable (weighs only 32 lbs.), battery-operated, and measures 21″ x 7″ x 20″.

The price of the Carboloy Machinability Computer is ... **$495.** (f.o.b. factory, Detroit)

Whether your plant is large or small, the Computer can bring you immediate benefits. Send the coupon, below, for complete information.

TYPICAL IN-PLANT COMPUTER APPLICATION

PROBLEM: Setting up 16″, 10-HP lathe to turn hot-rolled 1020 steel bar with 10″ diameter, to get tool life of 1 hour.

SOLUTION: Starting from scratch on a new setup, *days* could be used by experienced tool men to find a satisfactory set of operating conditions . . . with no assurance that the result would be the best possible. With the computer, the optimum setup was established, and the effect of changing key variables compared, in less than *15 minutes.*

BENEFITS: Computer turned lengthy setup time into valuable production time. On this job alone, the savings gained through days of extra production, plus savings in manpower costs, would more than equal the cost of the computer.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY
11147 E. 8 Mile Ave., Detroit 32, Michigan

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

Please send me more information on the Carboloy Machinability Computer.

Name_____

Company_____ Title_____

Address_____

City_____ Zone_____ State_____

For more information on products advertised, use Inquiry Card, page 239

Flame Hardened Embossing Rolls Have a LONGER PATTERN LIFE –

Rolls, such as this, are made at National Forge, engraved by the customer and returned to us for flame hardening.

These delicate patterns must hold up under high speed embossing of continuous strips of aluminum. The economical flame hardening process of heat treat imparts the desired hardness to just the portion of the surface necessary.

National Forge has equipment to flame harden forgings up to 24 inches in diameter and up to 21 feet long to regulated depths of 1/16 inch to 3/8 inch.

Flame hardening can effect economies for you. It can be restricted to just the areas requiring surface hardness. In many cases flame hardening permits the use of carbon steel instead of more expensive alloys. Send us your inquiries.

Send for detailed information on various applications of the FLAME HARDENING PROCESS

NATIONAL FORGE AND ORDNANCE COMPANY

PRODUCES BETTER STEEL FORGINGS AND MACHINE WORK

IRVINE, WARREN COUNTY, PENNSYLVANIA

Tool Steel Topics

BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributors: Bethlehem Steel Export Corporation

Production Up 50 pct with Bearcat Riveting Tool

For some time a manufacturer had been using a tool made of alloy steel, 2⅛ in. round, to cold-rivet weight-lever sets, 1 7/16 in. sq, for railroad switch stands. The tool was used in a series of rotating blows, average production being 70 pieces per tool before redressing was required.

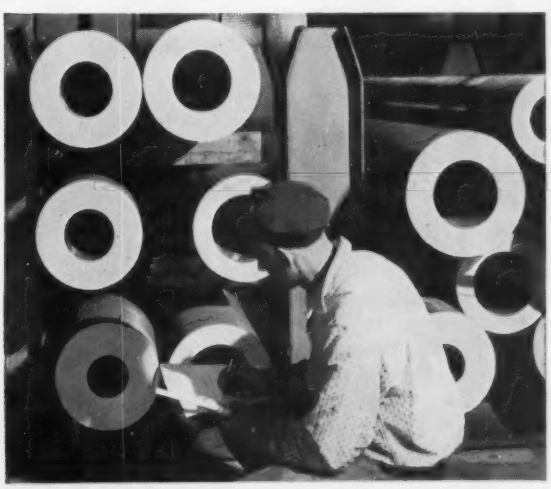
As the operation clearly called for steel with exceptional resistance to shock and wear, we suggested, "Why not give Bearcat a trial on that job? Bearcat's got the toughness you want. What's more, we wouldn't be surprised if it gave enough longer life to bring down your costs."

They made the change, with the result that tool life increased about 50 pct.

Bearcat is a tough, general-purpose grade of air-hardening tool steel. It has exceptional resistance to shock, and superior wear-resistance. Its air-hardening characteristic minimizes quenching hazards, and also provides good resistance to distortion in heat-treatment.

In addition to cold-riveting tools, there are many other applications in which Bearcat gives a good account of itself —in such tools, for example, as chisels, gripper dies, master hobs, hot headers, and die-casting die inserts.

Why not look into Bearcat? You can obtain full information from your Bethlehem tool steel distributor.



Save Time with Hollow-Bar in Ring-Type Applications

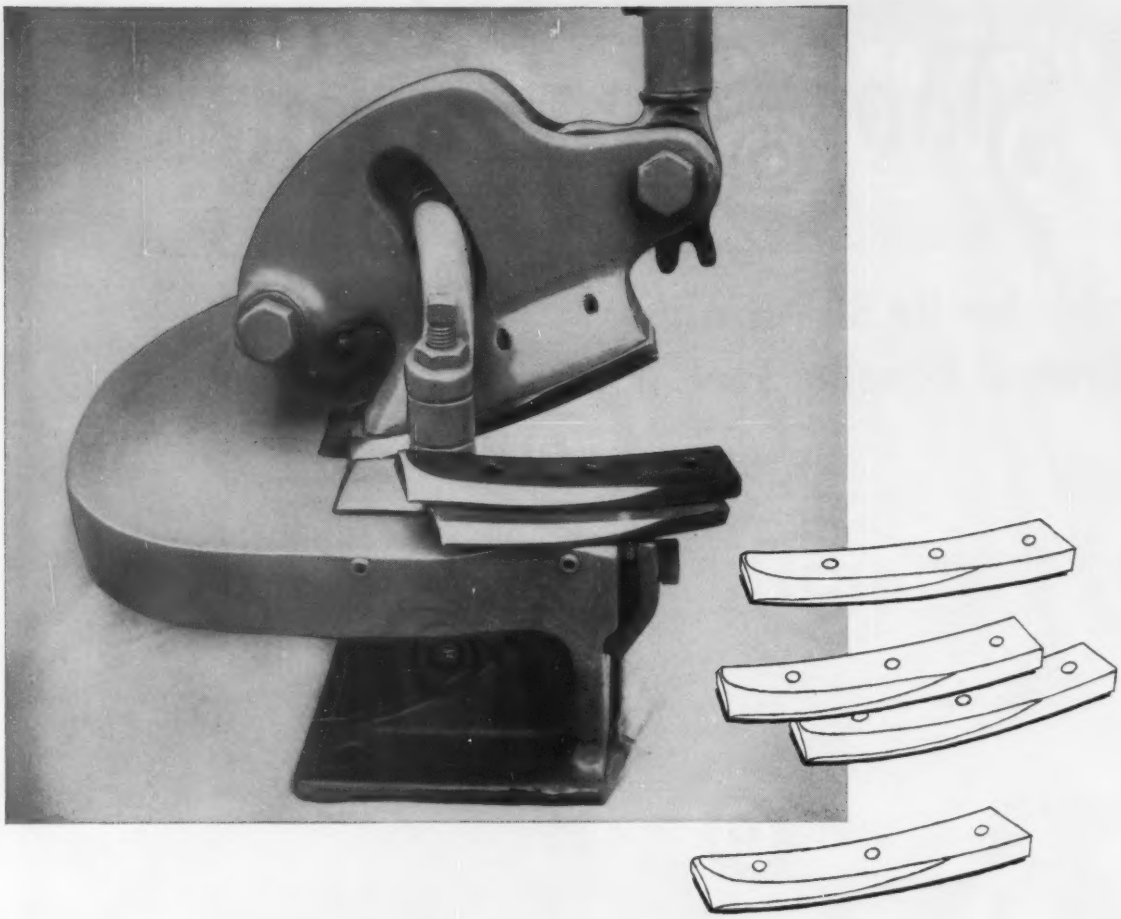
If you use draw rings, hardened bushings, ring dies or the like, you'll find you can save time in the shop with Hollow-Bar Tool Steel. Bethlehem Hollow-Bar comes in two types: BTR (oil-hardening) and Lehigh H (high-carbon, high-chrome). It's made by a high-speed trepanning process, which cores out the inside diameter of hammer-forged or hot-rolled, rough-turned bars. Hollow-Bar goes to work for you immediately. There's no waiting for forged rings or discs — nor are drilling, rough boring or facing, or rough turning required. Just think of the time that saves!

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Here's a Quick Look at Short-Run Dies

There are many types of dies used for blanking or forming where the production required may be only a few hundred pieces, or less. Such requirements occur frequently, as in the aircraft industry, for example. In such circumstances, the normal procedure of machining a die, then heat-treating and grinding it (to produce a die good for millions of parts) is neither practical nor economical. What is desired is a steel which can be machined to size, then used immediately.

One of our standard grades which is ideal for this application is Brake Die Tool Steel. Brake Die comes in rounds, squares and flats. It is a free-machining steel, and has been heat-treated at the mill to the highest hardness possible consistent with good machinability. On forming operations, dies made of Brake Die will last for tens of thousands of parts. And on blanking operations, it will produce anywhere from a few hundred parts to a few thousand, depending of course upon the type of material being blanked, and its thickness.



Shear Manufacturer ups blade life 4 to 5 times...

with A-L HURON DIE STEEL

Write for Your
HURON BLUE SHEET

A compilation of facts on the handling and shop treatment of Huron. Includes complete information on forging, annealing, tempering, etc. and detailed laboratory data on physical characteristics. *Ask for your free copy.*

Address Dept. M-71

A Chicago bench shear manufacturer produced some test blades of Ludlum HURON die steel—heat treated to 61-62 Rockwell C.

Service life of the HURON blades proved to be four to five times that of the former blades. Resharpenings were reduced 75 to 80%! Because these new HURON blades held an exact rake and maintained a proper cutting arc, they easily sheared $\frac{3}{16}$" mild steel or 10 gauge stainless.

Ludlum Huron was developed for use where high resistance to wear and abrasion is necessary, and where heavy pressure rather than sudden shock must be withstood. Huron has excellent non-deforming properties, and hardens to a great depth.

There is an A-L tool steel that will help solve your cutting, forming or blanking problem. Call our nearest office or distributor today, or write *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.*

For complete MODERN Tooling, call

Allegheny Ludlum

WAD 5329

AL® FINE TOOL STEELS SINCE 1854

standard for comparison

...and with high speed steels the standard is REX

Living up to a standard for comparison isn't easy. That's why Crucible lavishes special care on the manufacture of REX® high speed steels... to keep REX the *standard* wherever high speed steels are used—as it has been for over half a century.

It's easy to *prove* the superiority of REX. Use it on the job... check its size, structure, response to heat treatment, fine tool performance. You'll agree with thousands of other users—*you can't find a high speed steel to outperform REX.*

Remember, REX is made only by Crucible. So call for REX at any Crucible warehouse, or for quick mill delivery. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 30, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Automate for top performance with . . .

T-J Spacemaker CYLINDERS

CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
40% SPACE SAVED
T-J
T-J
T-J
T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

Style SM5 shown

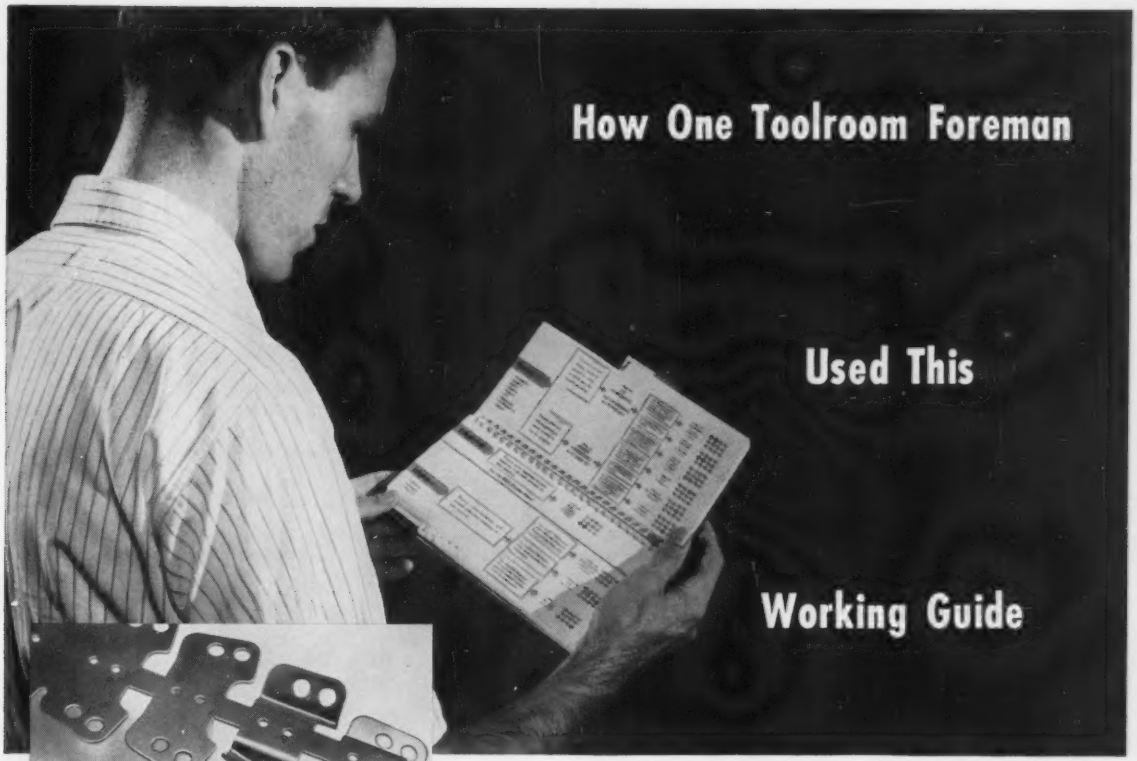
- The Only Cylinders with all the Extras as Standard
- OIL pressure to 750—AIR to 200 P.S.I.
- New Compact Design . . . Saves up to 40% Space
- Proven Performance . . . with Extra High Safety Factor
- Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion
- Hard Chrome Plated Bodies and Piston Rods (Standard)
- Only from T-J can you get these new ingenious cushion designs

More and more of industry's automation problems today—solved with T-J Spacemaker Cylinders! New compact design and many more plus features for a new high in efficient cylinder performance and dependability. Wide range of styles, capacities . . . to help you *save labor, reduce costs* on all kinds of push-pull-lift jobs. Send for bulletin SM-155-1. The Tomkins-Johnson Co., Jackson, Mich.

OFF SHELF DELIVERY

Member of the National Fluid Power Association

T-J TOMKINS-JOHNSON
RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS



Job: Punch that blanks stampings from SAE 1010 strip, .062" thick.

Problem: The punch is so unbalanced in design that safety in hardening is vital. Also, the punch is shear fitted to the die, and hardening accuracy is necessary to avoid expensive adjustments after heat treating. Other die steels were tried, but they either broke or changed size too much.

Solution: At this point the Toolroom Foreman called in Carpenter and started to become more familiar with the Matched Tool and Die Steel Manual. The Manual pointed to Carpenter *Vega* (Air-Tough) Die Steel for the punch. Now they're coming through right on the nose. Moreover, production between grinds has jumped from about 10,000 to 50,000 stampings. And the Foreman says that from here on, all his tools and dies will be made from Carpenter Matched Tool and Die Steels. (Write for a more detailed Field Report on this job.)

. . . To Increase Tooling Productivity

This is for the man responsible for tools and dies who looks at a diemaking job with these thoughts:

"How can I make it *easier?*"

"How can I avoid costly *heat treating hazards?*"

"What can I do to *improve the job?*"

If you're that man, Carpenter wants to help. We offer you plain, *practical* help based on almost 70 years' experience working with other men who feel like you do.

How does it pay off? Look at a typical example shown to the left! And your Carpenter representative can show you many more Field Reports of other interesting jobs.

Much of this help is packed into a 189-page working guide . . . Carpenter's "Matched Tool and Die Steel Manual". And that's only part of the program . . . a program backed by *dependable* die steels developed in Carpenter Research Laboratories with a long record of pioneering in new and improved steels.

We're ready to work with you, now. A call to your nearest Carpenter Mill-Branch Warehouse, Office or Distributor will tell us you are, too.

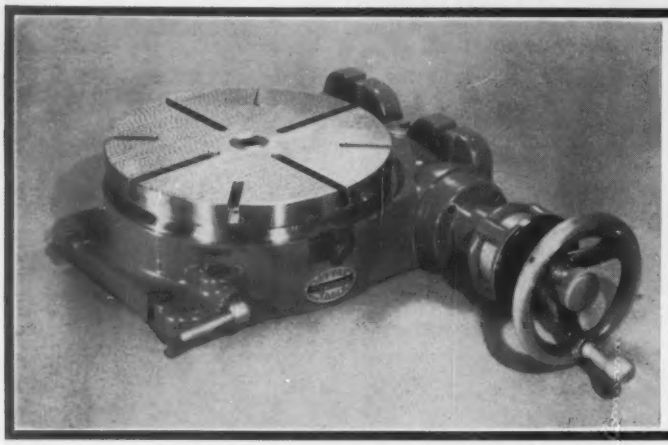
Carpenter STEEL — Matched Tool and Die Steels

IMMEDIATE DELIVERY from local warehouse stocks

THE CARPENTER STEEL CO., 105 W. Bern St., Reading, Pa.

Export Department: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

For angular spacing jobs so precise you could never handle them before



A Rotary Table accurate to ± 3 sec. in 360°
(USING CHART)

No. 2 Moore 11-Inch Rotary Table, *developed by the builder of the Jig Borer and Jig Grinder.*

THE FOLLOWING ACCURACY BUILT FOR SHOP USE:

All points in 90° increments, from zero, ± 1½ sec.
All points in 18° increments, from zero, ± 2 sec.
All points in 2° increments, from zero, ± 4 sec.
Worm accuracy, ± 1 sec.
Repetition of settings, ± 1 sec.
4 sec. = .0001" on 10" dia.

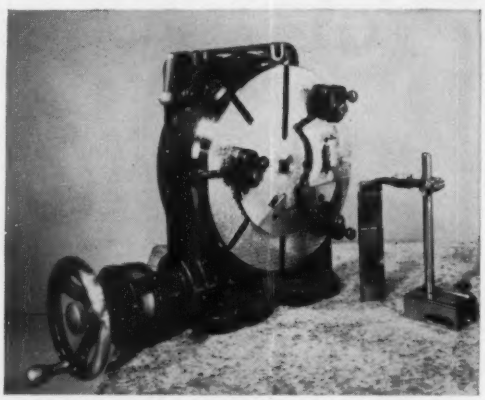
How many jobs have slipped by you because the angular spacing requirements were just too much for your equipment?

With Moore's new 11-Inch Rotary Table, you can easily handle the most precise angular measurements. Having an overall performance accuracy of ± 6 seconds throughout the entire 360°, this table is already being used successfully by several leading companies on government-sponsored precision jobs never before accomplished.

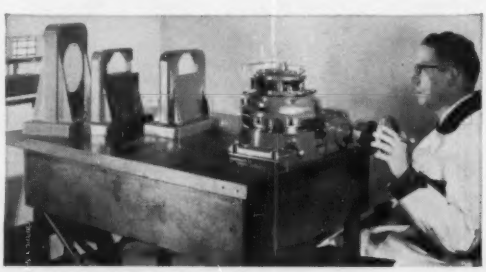
This extreme accuracy is achieved by a non-disengagable, thread-ground worm, combined with accurately spaced teeth of its mating gear. An ultra-sensitive method of angular measurement—interferometric inspection and calibration—used industrially for the first time, assures tooth spacing accuracy within less than ± 4 seconds.

You can use this rotary table for countless precision spacing applications on jig borers and jig grinders. Examples: Spacing holes in a circle on either machine; set at right angle for additional machining and inspection jobs; with its companion unit, the new No. 2 Sine Plate, to produce compound angle settings. Write today for Bulletin RT2.

MOORE SPECIAL TOOL COMPANY, INC.
734 UNION AVENUE, BRIDGEPORT 7, CONNECTICUT



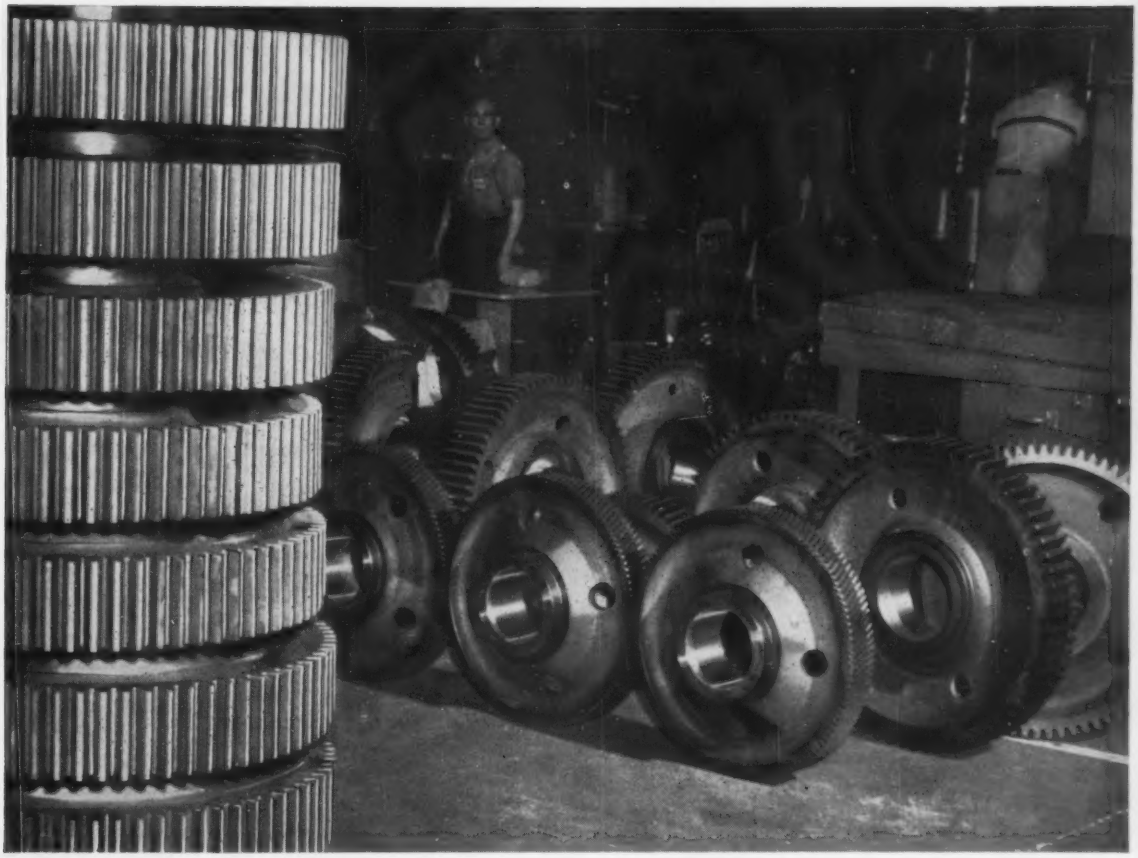
Accurate in vertical as well as horizontal position. Additional vernier permits normal reading even in vertical position.



Accuracy assured by interferometric inspection and calibration. This is the first time industry has used light-wave measuring methods for precise division of the circle.

ADD MOORE SPEED + ACCURACY TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES



Good, Strong Gears Begin with Good, Strong Blanks

Because strength is usually the first requirement in a gear, Bethlehem devotes unusual care to the making of gear blanks. And equally important, Bethlehem has developed a process of manufacture that assures high strength *without* excessive weight.

This process is unique; there is nothing else like it. First, a heated round is placed in a special mill where it is upset, forged and rolled in a single operation. The resulting blank is dense, homogeneous, compact; the grain flow of the steel is smooth and uniform.

These characteristics go hand in hand with strength. Moreover, blanks made by this method are easy to machine, and fewer cuts are required in a good many cases.

When making gears—spur, bevel, miter, helical, and others—you can rely completely on Bethlehem blanks. But their use is not confined to gears alone. In fact, they're excellent for a long list of applications—crane wheels, industrial wheels, turbine rotors, clutch and brake drums, sheave wheels, flywheels, pipe flanges, tire molds, etc. The blanks are available in sizes from 10 to 42 in. OD, and can be furnished treated or untreated.

If you would like more complete information, write for a copy of Booklet 216. It will be sent to you promptly without cost or obligation.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

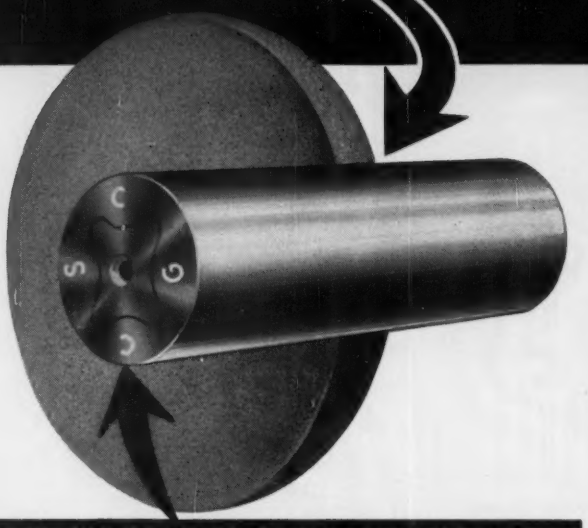
BETHLEHEM STEEL

An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight,
smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 INCORPORATED 1892

Massey-Harris-Ferguson eliminates reworking of finished pieces with Surfindicator. This production tool cuts their machining cost.

"SURFINDICATOR* *cuts our costs by eliminating extra machining"*

The Brush SURFINDICATOR enables the operator to measure, at the machine, the exact surface finish which he is producing. Thus, it allows him to take necessary steps to make this the optimum surface finish from a cost to performance standpoint. The surface finish of these farm implement parts is checked right on the production floor at Massey-Harris-Ferguson Inc., Racine, Wisconsin.

They state: "Using the SURFINDICATOR, we can immediately see if parts are within the range of design specifications for finish. Considerable machining time and cost has been saved by eliminating reworking of finished pieces to meet specifications. The Surfindicator is an asset to our work because of its portability and simple direct measurement."

You can cut *your* costs, simplify *your* inspection with the SURFINDICATOR. Let a Brush representative demonstrate this portable, easy-to-use instrument in your plant. Send coupon today.

*Trade-Mark

BRUSH ELECTRONICS COMPANY

INDUSTRIAL AND RESEARCH INSTRUMENTS
PIEZOELECTRIC MATERIALS • ACOUSTIC DEVICES
MAGNETIC RECORDING EQUIPMENT AND COMPONENTS

BRUSH ELECTRONICS

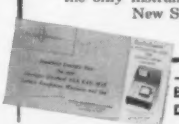
Division of Clevite Corporation

SEE THE SURFINDICATOR AT THE NATIONAL METAL EXPOSITION IN PHILADELPHIA, BOOTH No. 1728.

NEW ASA STANDARD SIMPLIFIES SPECIFYING AND MEASURING SURFACE FINISH

One uniform standard for surface finish now replaces many individual practices. You can now specify surface roughness and character of a surface in the same terms as other plants, your suppliers and your customers.

Send for new booklet containing important excerpts on the ASA STANDARD and including information of the SURFINDICATOR . . . the only instrument completely meeting the New Standard.



BRUSH ELECTRONICS COMPANY
Dept. D-11, 3405 Perkins Avenue
Cleveland 14, Ohio

☐ Please send booklet describing advantages of new ASA Standard B46.1.

☐ Please have your representative call and demonstrate the SURFINDICATOR.

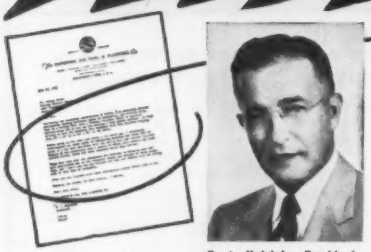
Name _____
Position _____
Company _____
Address _____
City _____ *State* _____

PORTAGE offers 10 MINUTE change over time

FROM BORING, MILLING, DRILLING to DUPLICATING

...all in ONE machine...from ONE source

Boring, Drilling, Milling and Duplicating operations all done in one set up
. . . one machine . . . one operator, no loss of change over time.



P. J. Holstein, President
The Superior Die, Tool & Machine Co.
Columbus 7, Ohio

Read What One User Has to Say!

Portage Machine Company
1025 Sweitzer Avenue
Akron 11, Ohio

Gentlemen:

Before going in for this type setup, I completely investigated all other types of contouring machines and found that we could be a lot more universal with the Portage Boring Mill and Turchan Hydraulic Follower because we can accurately bore a series of holes, mill pockets and also outside bosses, where the other machines would only contour.

Today more than ever the die business is becoming more and more complicated due to the irregular shapes and designs of these stampings, and I don't see how any Tool and Die Shop can compete without having this type of equipment.

Yours very truly,

P. J. Holstein

THE SUPERIOR DIE, TOOL & MACHINE CO.

PORTAGE
METAL WORKING SPECIALISTS

THE PORTAGE MACHINE CO.

1036 Sweitzer Avenue • Akron 11, Ohio

Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

Wide range of models

NEW BRITAIN +GF+

COPY TURNING MACHINE

Changed over in minutes, using simple template, or prototype.

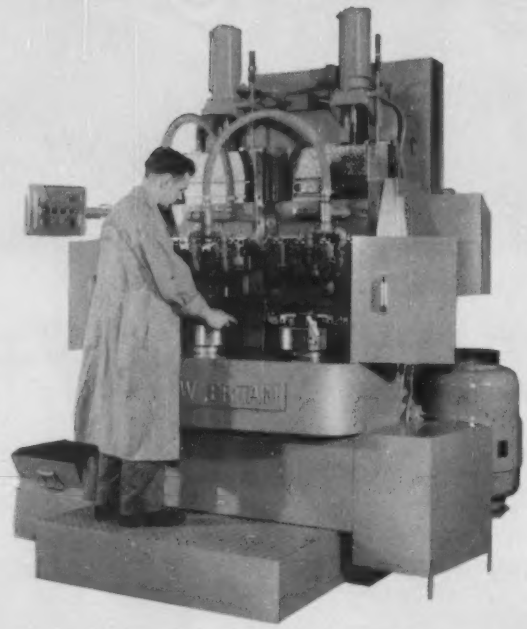
Created specifically for profitable copy turning and boring. Ask your New Britain representative for a showing of the color motion picture "A NEW APPROACH TO COPY TURNING" in your own plant. Or write The New Britain Machine Co., New Britain, Conn.

Economical for short or production runs.

See the following four pages for other New Britain New's.

New Approach to Precision Boring

It's cam actuated • It's vertical • It's New Britain

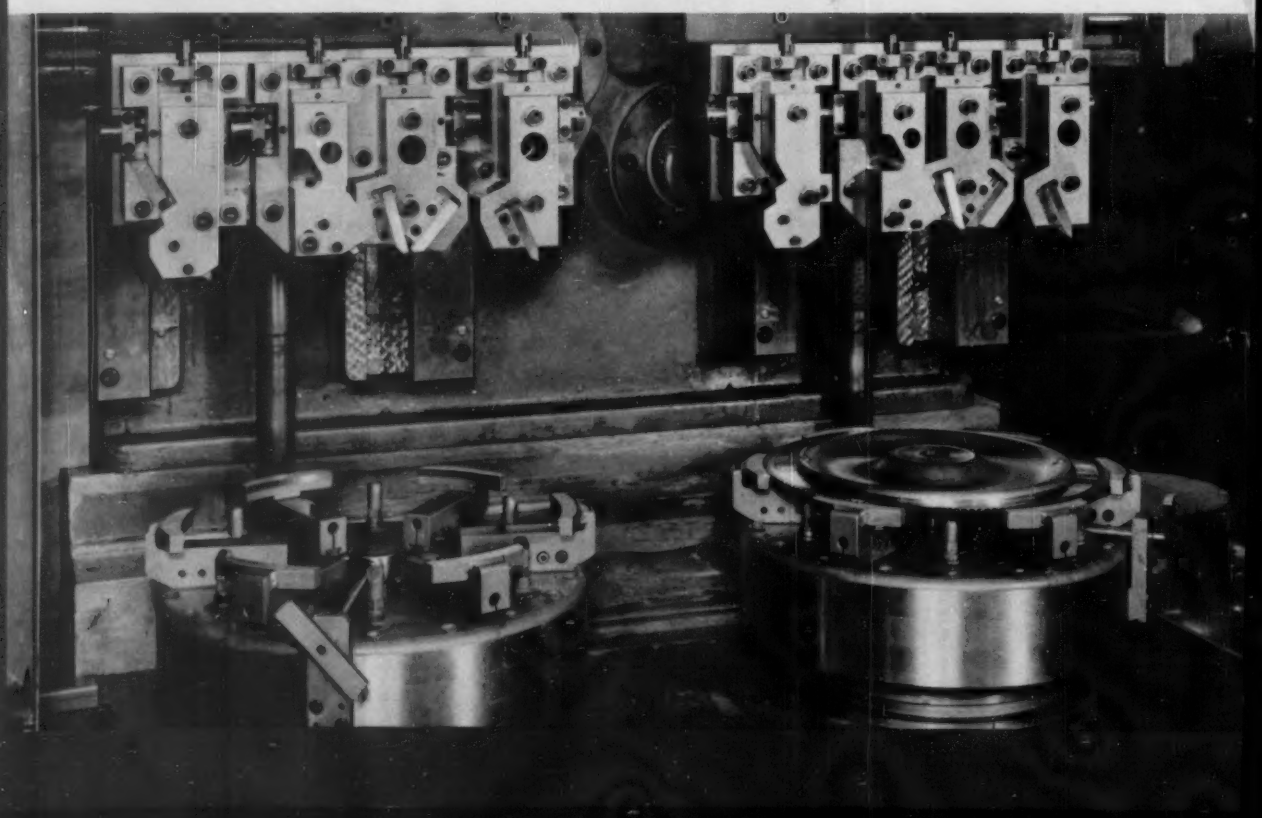


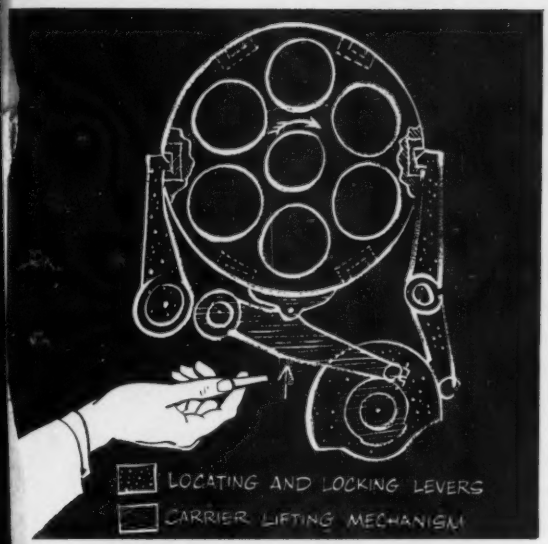
It extends the speed, accuracy and fine finish of precision straight and contour boring and turning to an even wider range of work.

New Britain's new vertical models feature accurate control of tool paths and cycle timing. This is the basic approach to precision boring employed in New Britain's famous single and double-end boring machines.

Shown below: a close-up of the tooling area of the Model 210 New Britain Vertical Precision Boring Machine at the top of the page.

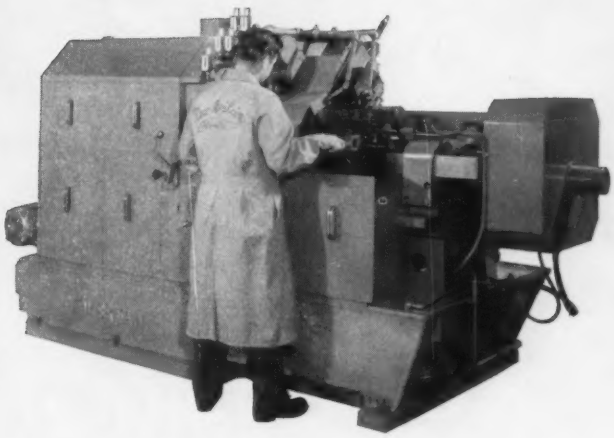
Two pieces are machined simultaneously by duplicate sets of tools. Left hand piece has been removed to show construction of chuck.





Even slight wear on the spindle carrier or its locating pads would destroy accurate alignment of end-working tools with center line of the spindle. Blackboard sketch shows how carrier is lifted during index, positively located and locked during cutting cycle.

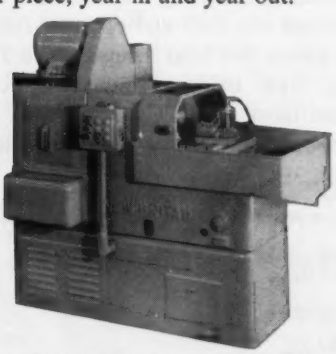
Billions of indexes with absolutely no wear!



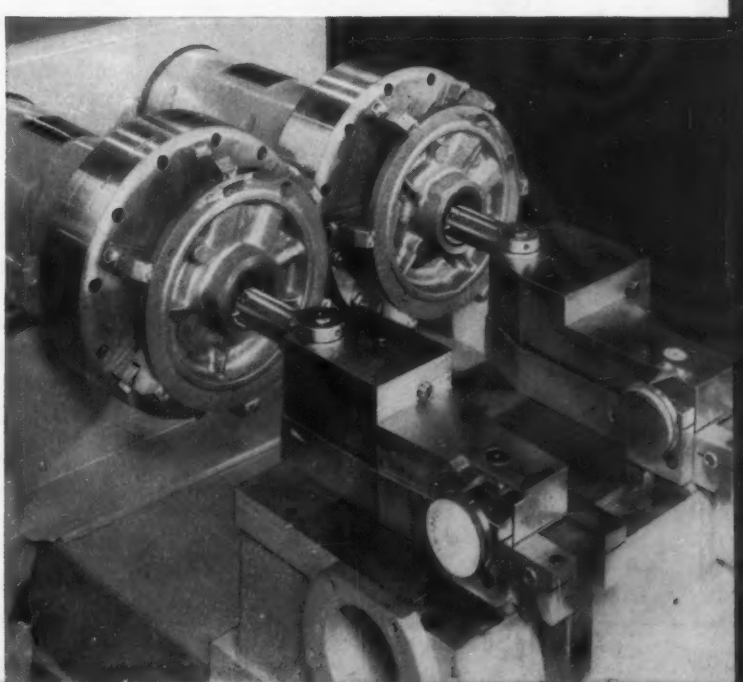
Experienced shop men say: *New Britain Chuckers stay on the job and stay accurate*. That sums up the profitable end results of exclusive features like the one described at the left.

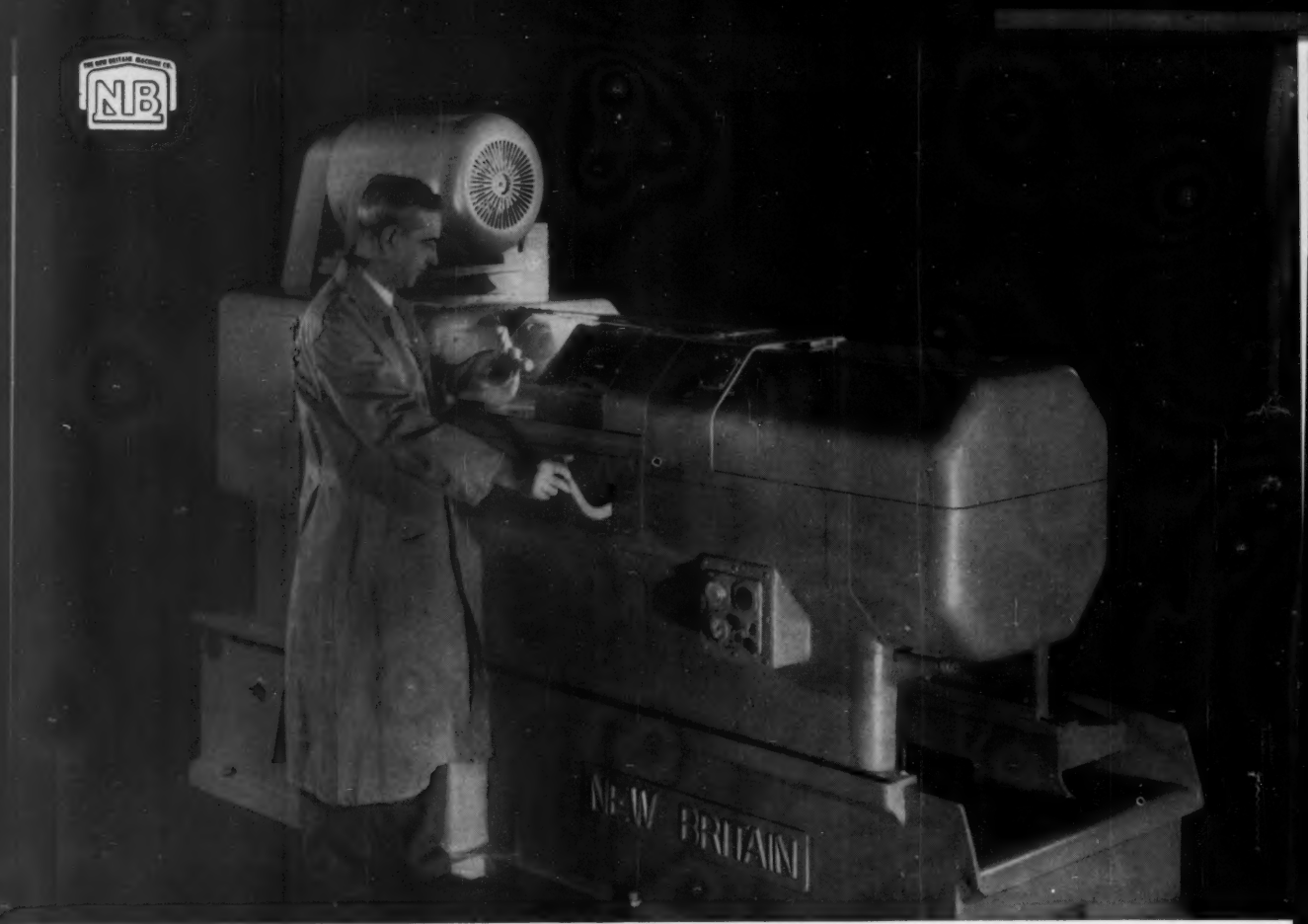
The secret of precision boring is constant close control of the tool

Successful precision boring and turning calls for control of tool paths and cycle timing, both with "gage makers' " accuracy. Precision ground cams insure this accuracy under all conditions on a New Britain. This hairline control, combined with ruggedness and stamina for *permanent* accuracy, produces fine finishes piece after piece, year in and year out.

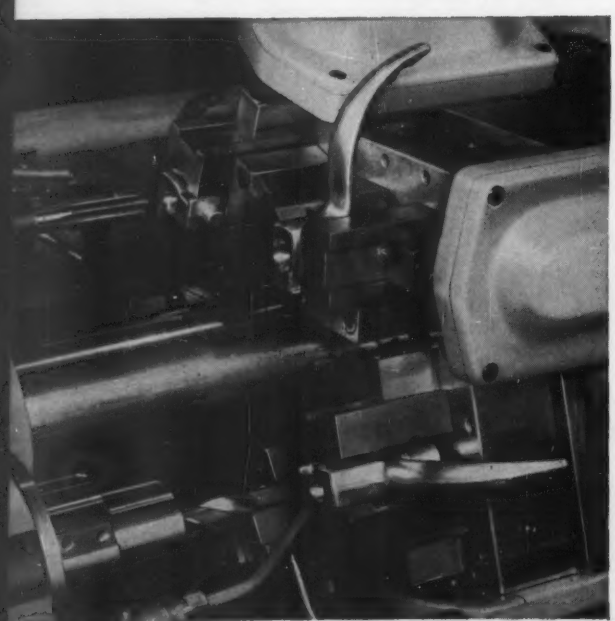


See the preceding two pages and the two following for other New Britain New's.





New New Britain Chucker will produce pieces as fast as operator can load them.



Irregularly shaped pieces — parts difficult to swing on a work-rotating chucker — pieces hard to produce at a profit, belong on the New Britain Model 23B.

This four-spindle chucker can machine up to 1290 pieces per hour (that's one every three seconds). A fifth, easily-operated, quick-acting chuck in the loading position minimizes idle time and operator fatigue.

If you produce pieces that lend themselves to a tool rotating machine, New Britain Model 23B could become one of the most valuable machines in your shop. Check with the New Britain man or write for Catalog on Model 23B.

LUCAS OF CLEVELAND

Model 6120S Lucas Precision Horizontal Boring Machine built for a large stamping plant, is used for reconditioning, altering and originating large die sections.

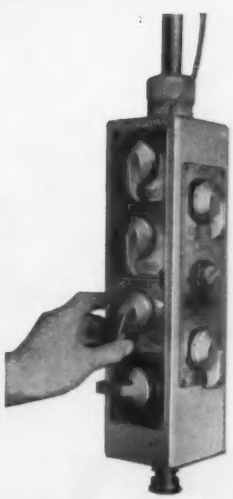
This short bed space-saving machine incorporates all the features of standard machines except a backrest for bar support. The 120" wide bed is of one piece construction for rigid table and saddle support.

This machine is ideally suited to heavy die work which combines operations of boring, drilling and milling in both high and low speeds.

This Lucas will be YEARS AHEAD for a long time

Because Lucas applies its engineering skill to boring machines exclusively — because so many of the important improvements have originated at Lucas — because every new development is incorporated in the next lot built, *you get the latest first when you buy a Lucas.*

For example: Lucas, one of the first to develop pendant controls on the Horizontal Boring Machine, now offers a new, compact, lightweight control pendant with smooth operating multi-purpose directional switch levers. Or take Lucas Automatic Power Positioning, with built-in, pre-set positioning feed which positively repeats a series of operations without the use of jigs and fixtures. Read more about these features and many other points of Lucas leadership — write for the complete story in detail. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.



• AUTOMATIC BAR and CHUCKING MACHINES • PRECISION BORING MACHINES
• LUCAS HORIZONTAL BORING, DRILLING and MILLING MACHINES • NEW BRITAIN +GF+ COPYING LATHES

The NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division, New Britain, Connecticut
Lucas Machine Division, Cleveland 8, Ohio

See the preceding four pages for other New Britain *New's*.

time tested designing with MADISON-KIPP zinc and aluminum die castings

The pumping unit is the most vital component in Madison-Kipp high pressure lubricators. The one here illustrated is used for pressures up to 2500 lbs.

Free use of iron and steel and brass inserts are features of many lubricator die castings as in the Aluminum Housing shown above.

The exacting service requirements of accurate measuring and forcing devices is something in which we have qualified as experts for nearly sixty years. Perhaps our time tested design formulas may be of help to you.

We will be pleased to review your blue prints.

kipp

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U. S. A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tool

For more information on products advertised, use Inquiry Card, page 239

"excellent finish"

SURVEY

DESCRIPTION OF WORK
Surface grinding tool bits to size on production basis.

SEGMENTS
Simonds Abrasive Company NA 36-G9-B3

PERFORMANCE
Excellent finish, plus long segment life. Performance unequalled by other makes of segments over many years.

SIMONDS ABRASIVE CO.

abrasive segments

Send for catalog bulletin "Abrasive Segments" form SBA-150

Superior results plus long productive use! This is the constantly recurring theme of surveys covering jobs on which Simonds Segments are used. You'll find them equally productive and durable on your jobs.

SIMONDS ABRASIVE COMPANY • PHILADELPHIA 37, PA.

Branch Warehouses: Boston, Detroit, Chicago, Portland, San Francisco • Distributors in Principal Cities
Division of Simonds Saw and Steel Co., Fitchburg, Mass. • Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Quebec, Lion Grinding Wheels Div., Brockville, Ont. and Simonds Canada Abrasive Co., Ltd., Arvida, Quebec

EXTRA SAVINGS FROM YOUR SIMONDS DISTRIBUTOR
STOCK · SERVICE · KNOW-HOW

Get ENGINEERED felt from American

YOU'LL LIKE IT, AS DOES Whirlpool

STATEMENT BY Whirlpool

"Whirlpool Corporation has used felt products for some time. At present they are used on our new high-speed dryer as well as our conventional dryer. Felt is satisfactory as to pressure or vacuum, and it is giving satisfactory service as to temperature resistance.

"The particular type of felt which we are buying is much more satisfactory than anything previously used, including other materials. This is because of the resiliency of the material, which is designed inherently to flex back into its original position."

American supplies Whirlpool Corporation, St. Joseph, Mich., with felt for its dryers. The Imperial model shown here uses plain felt as a seal at the loading port. At the exhaust, where the air is hot and full of moisture, the felt is blended with Hycar, which provides moisture resistance. The dryer drum rotates at 45 r.p.m., and the felt seals effectively keep heated air and moisture out of the cabinet, and heated air in the drum at somewhat less than atmospheric pressure during operation. The seals are supplied as sewn rings, ready for fast, economical installation.

This is an outstanding example of thorough engineering applied to an application of felt. American will be glad to collaborate with you on the use of felt on your present or proposed products.

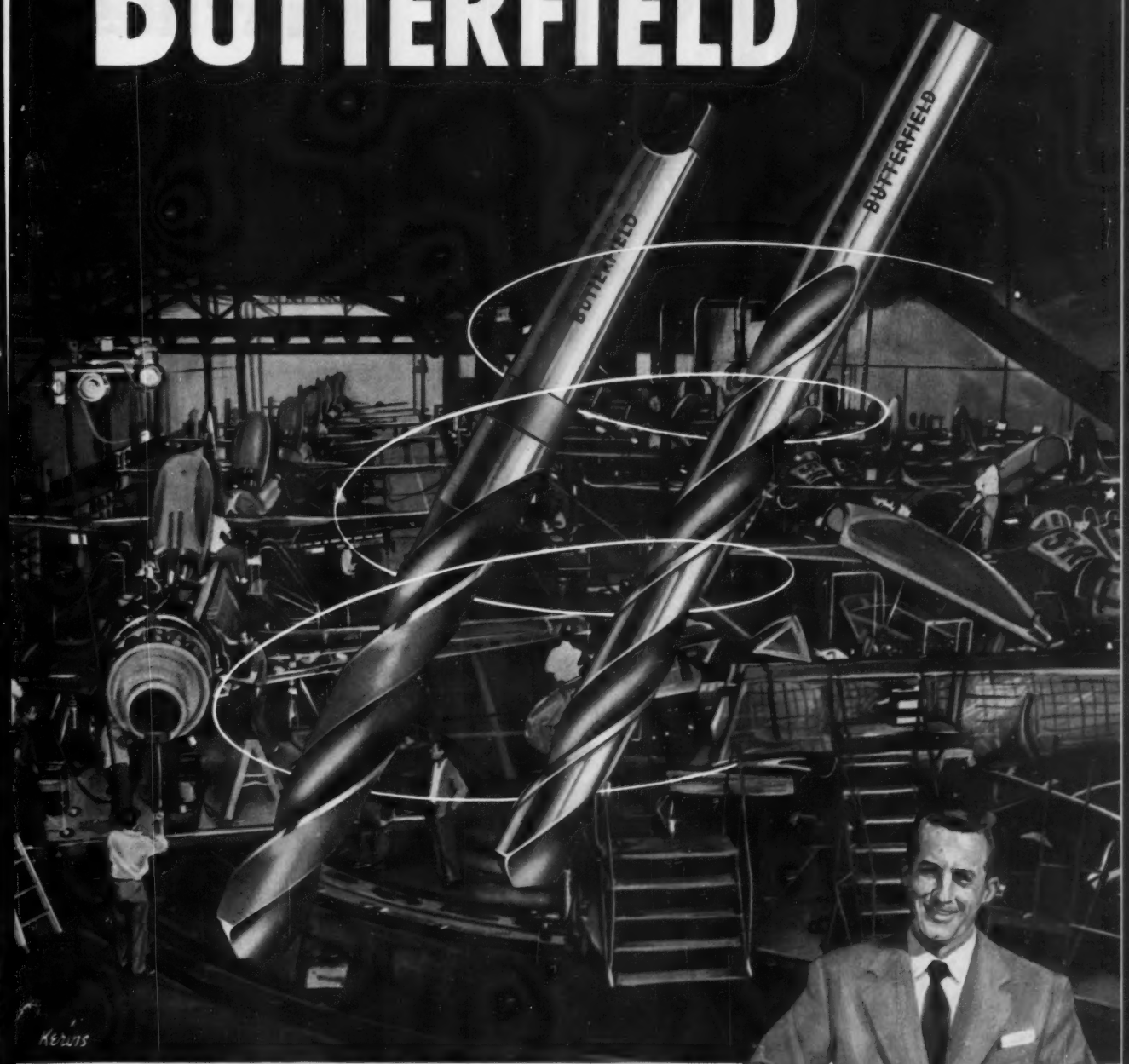
American Felt Company
TRADE MARK ®

GENERAL OFFICES: 68 GLENVILLE ROAD, GLENVILLE, CONN.

SALES OFFICES: New York, Boston, Chicago, Detroit, Cleveland, Rochester, Philadelphia, St. Louis, Atlanta, Dallas, San Francisco, Los Angeles, Portland, Seattle, Montreal.—PLANTS: Glenville, Conn.; Franklin, Mass.; Newburgh, N. Y.; Detroit, Mich.; Westerly, R. I.—ENGINEERING AND RESEARCH LABORATORIES: Glenville, Conn.

For more information on products advertised, use Inquiry Card, page 239

BUTTERFIELD



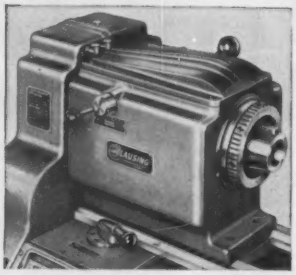
A COMPLETE LINE OF QUALITY cutting tools is now available from your Butterfield distributor. Drills are made to the same exacting standards as Butterfield Milling Cutters, Taps, Dies, Reamers, Counterbores and End Mills.

UNION TWIST DRILL COMPANY
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U. S. A.

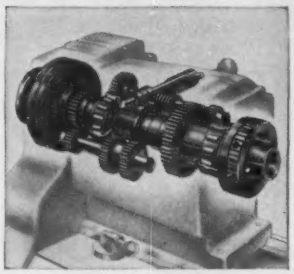
FOR FAST ECONOMICAL SERVICE
CALL YOUR **BUTTERFIELD**
DISTRIBUTOR

CLAUSING LATHES

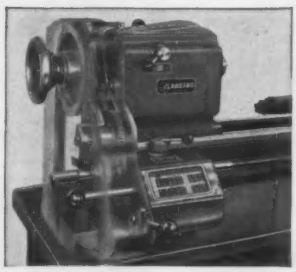
YOUR CHECK LIST OF LATHE VALUE



☑ **Is headstock fully enclosed with gears traveling in oil bath?**



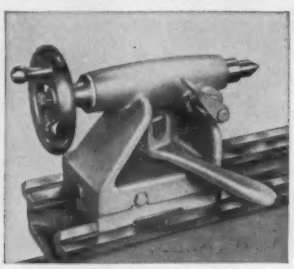
☑ **Does spindle turn on widely spaced "Zero-Precision" Timken tapered roller bearings?**



☑ **Does it have fully enclosed dual-belt outboard drive with quick, easy belt replacement?**

☑ **Is Quick-Change box fully enclosed with gears and shafts running in bath of oil?**

☑ **Is automatic apron fully enclosed with entire mechanism running in sealed oil bath?**



☑ **Does tailstock have No. 3 M.T. ram with tang socket and permanently attached swing type wrench?**

for *Precision Performance Economy*

Within its price range and capacity the CLAUSING 6300 series lathe sets the standards for Precision, Performance and Economy!

Its exceptional performance on production, tool room, maintenance and laboratory work is the direct result of its many advanced and exclusive features of design and construction.

For example, the 6300 headstock is fully enclosed and all moving parts run in a pumped bath of oil. Spindle is forged, precision-ground steel with 1⅜" bore and 1" collet capacity . . . turns on "Zero-Precision" Timken tapered roller bearings. Hardened and ground spindle nose is L-00 tapered key-locked type. Dual A-belt drive with spindle pulley mounted outboard . . . you can replace belts quickly without having to remove spindle. Quick-change mechanism provides instant selection of 48 threads or feeds. Both quick-change mechanism and double-walled apron are enclosed and gears and shafts run in bath of oil. The heavy-duty tailstock has No. 3 M.T. ram with tang socket.

What's more, the superior performance of the 6300 is assured! Before it leaves the factory, each CLAUSING Lathe must pass rigid tolerance tests such as:

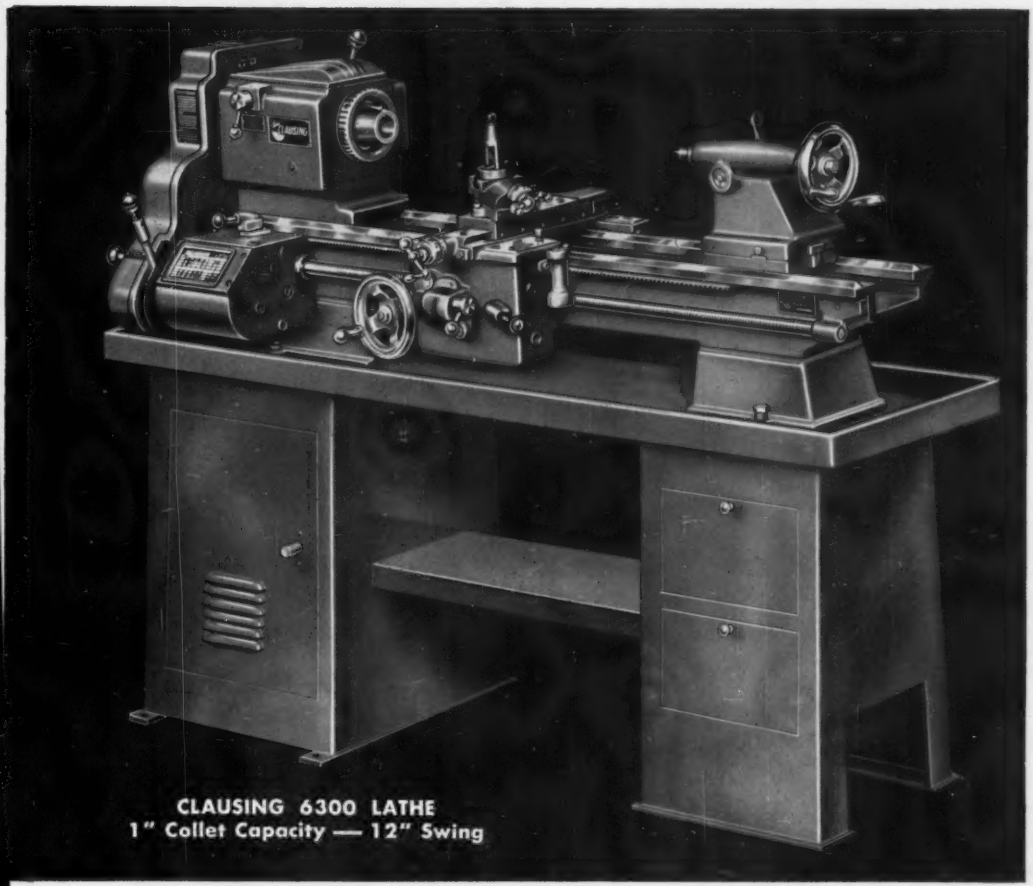
1. Spindle Nose Runout, total indicator reading..0 to .0003".
2. Spindle Taper Runout, at end of 12" test bar....0 to .0006".
3. Headstock Alignment (horizontal) at end of 12" test bar.....0 to .0003".
4. Tailstock Spindle Alignment (vertical) high at end of spindle when fully extended.....0 to .0008".
5. With work mounted in chuck, lathe must turn round within .....0 to .0003".

See the new CLAUSING at your nearest Atlas-CLAUSING dealer's before you decide on *any* lathe. Write for catalog TODAY!

Atlas CLAUSING PRECISION MACHINE TOOLS
DIVISION ATLAS PRESS COMPANY KALAMAZOO, MICHIGAN U. S. A.

the PLUS VALUE LINE

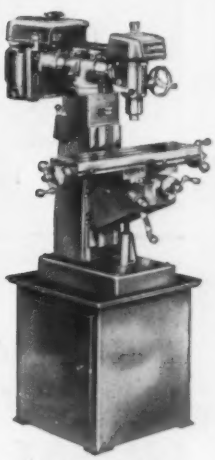
SET THE STANDARDS



CLAUSING 6300 LATHE
1" Collet Capacity — 12" Swing

CLAUSING 18" POWER FEED DRILL PRESS

Designed for heavy-duty operations! Drills ¾" in steel, 1" in cast iron. 63/64" diameter spindle — 6½" travel. 39" spindle to table — .001" depth accuracy. Gear-Driven, Dial-Selection Power Feed with oil-bath lubrication.



CLAUSING VERTICAL MILLER

A highly precise, heavy-duty machine tool that Mills, Drills, Bores, Reams and Shapes . . . at all angles . . . with one work setup!

CONDENSED SPECIFICATIONS

CAPACITY — Swing: 12¾" over bed; 12⅜" over saddle wings; 7⅝" over saddle. 21½"-33½"-47" between centers. Beds: 47"-59"-72½".

BED — 7⅜" wide, 5⅛" deep. Two Vee, two flat ways and underside of bed are precision-ground.

THREAD RANGE — 48 selections, 4 to 224 Standard, right or left.

SPINDLE SPEEDS — Countershaft Drive, 8 (50-1300 R.P.M.). Variable Speed Drive, Infinite (30-1400 R.P.M.).

POWER LONGITUDINAL FEEDS — From .00065" to .0367" (left or right) per revolution of spindle.

LEAD SCREW — ⅞" diam., 8 Acme threads per inch.

CROSS FEEDS — From .00016" to .00917" per revolution of spindle. Cross feed travel is 9⅛".

SPINDLE — Tapered Key-type, A.S.A. — L-00. 1" collet capacity. Internal taper, No. 4½ M.T. 1⅜" bore sleeved for No. 3 M.T.

COMPOUND REST — Graduated 0 to 90° right and left. 2 9/16" travel.

COUNTERSHAFT DRIVE — Countershaft has ball bearing equipped shaft, 2-step drive pulley, ½" A-section belts. 4-step motor pulley with ¾" diam. hole. ¾ or 1 HP, 1725 RPM motor recommended.

CLAUSING DIVISION

Atlas Press Company
Quality Machine Tools Since 1911
11-108 N. Pitcher KALAMAZOO, MICH.

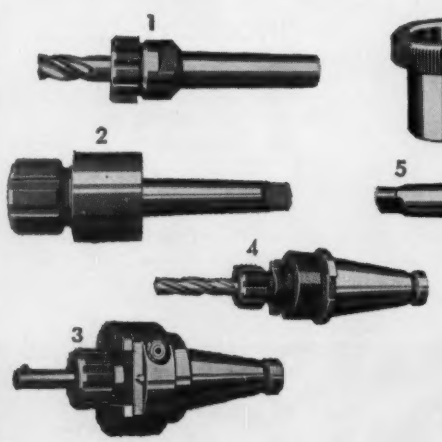
MEET THE CHAMP!

UNIVERSAL DRILL BUSHINGS BEAT ALL RECORDS FOR LONG LIFE AND ACCURACY

The extremely long life of Universal Drill Bushings is due to several factors. They are machined from finest quality steel. Their superfinish bores help to reduce both wear of the bushing and wear of the tools. Blended radius on the top inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy and uniform quality. Knurled heads provide a quick, sure grip. Available in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.

179

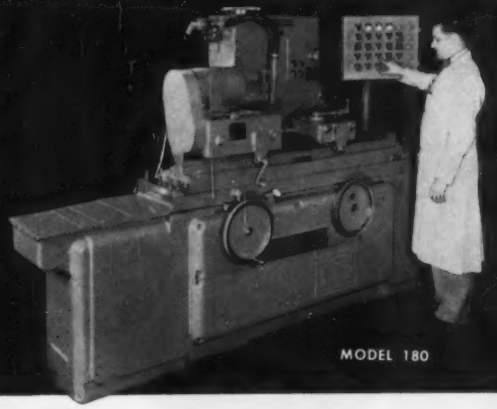
UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 2
MICHIGAN



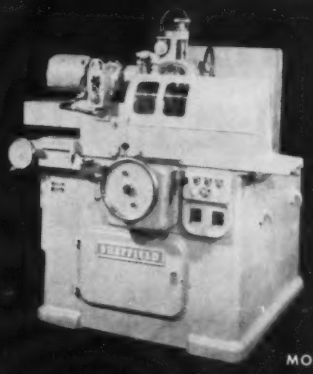
1 STANDARD COLLET CHUCK
2 FLOATING COLLET CHUCK
3 BORING CHUCK
4 "KWIK-SWITCH" TOOL HOLDER
5 MIKRO-LOK BORING BAR
6 STANDARD DRILL BUSHING
7 UNIVERSAL INDEX PLUNGER

For more information on products advertised, use Inquiry Card, page 239

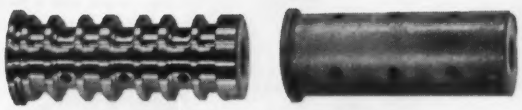
Grind PRECISION FORMS, GROOVES and LANDS *in Record Time* with SHEFFIELD'S CRUSHTRUE MULTIFORM GRINDERS



MODEL 180



MODEL 109

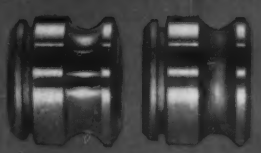


Servo Mechanism Sleeve

The seven grooves of this servo mechanism sleeve are crushtrue ground from the solid to a tolerance of .001" on spacing and .002" on minor diameter in 55 seconds. Material, SAE 52-100; Rockwell, 58-60 C; depth of plunge grind, .145".

Forms and grooves are precision ground on these machines with comparable speed and economy.

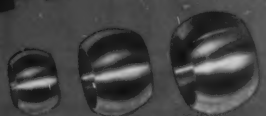
For complete details write to Department 810, The Sheffield Corporation, Dayton 1, Ohio, U.S.A.



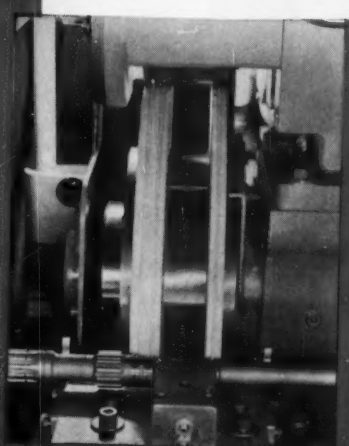
Bearing Race

Aircraft Servo Component

Hydraulic Servo Units



Self-aligning Bearings



Grinding Grooves in a Transmission Shaft

Crushtrue Roll

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

MANUFACTURE AND ASSEMBLY OF RANGE

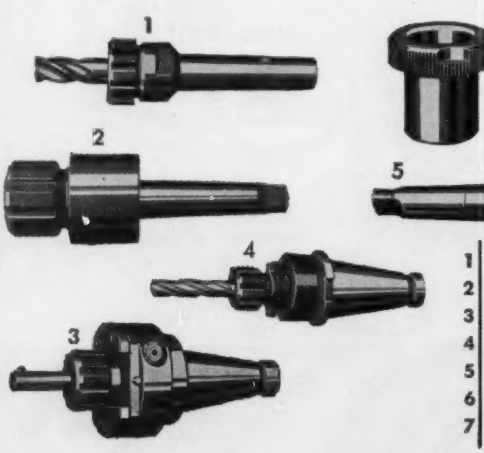
MEET THE CHAMP!

UNIVERSAL DRILL BUSHINGS BEAT ALL RECORDS FOR LONG LIFE AND ACCURACY

The extremely long life of Universal Drill Bushings is due to several factors. They are machined from finest quality steel. Their superfinish bores help to reduce both wear of the bushing and wear of the tools. Blended radius on the top inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy and uniform quality. Knurled heads provide a quick, sure grip. Available in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.

179

UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 2
MICHIGAN



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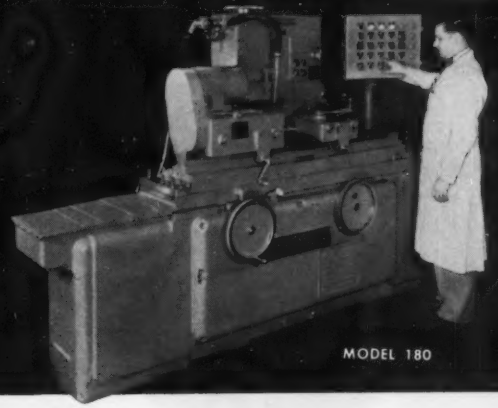

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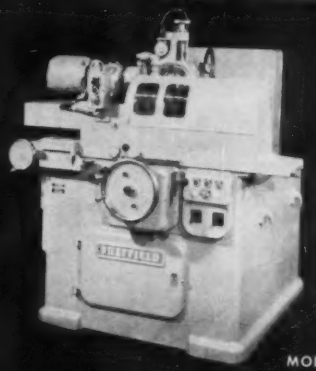

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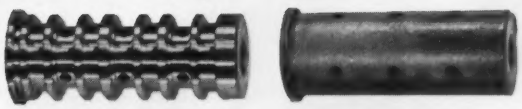

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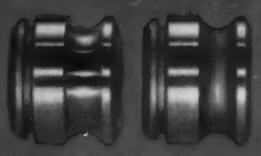

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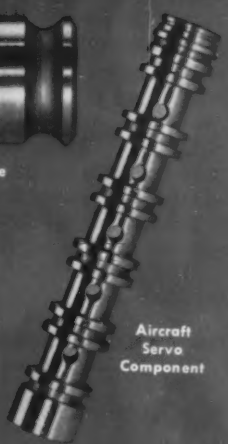

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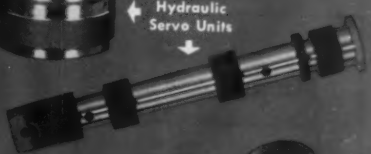

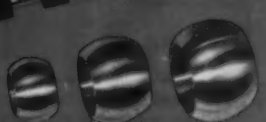

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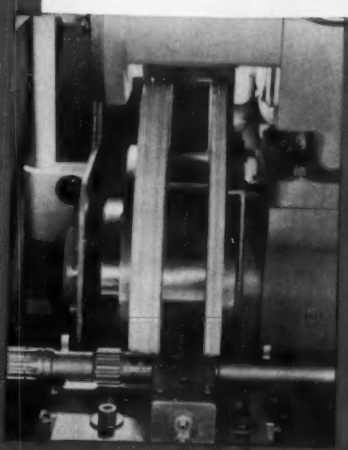


Grinding Grooves in a Transmission Shaft

Crushtrue Roll

SHEFFIELD HEADQUARTERS

SHEFFIELD

MANUFACTURERS AND MEASUREMENT FOR MACHINING

KLOZURE* OIL SEALS

USED EXCLUSIVELY on RBC's new Sealed "Pitchlign" Roller Bearings

Springless KLOZURE Oil Seal Model 71-A, with synthetic rubber sealing member securely bonded to and integral with a metal case.

In designing their new sealed "Pitchlign" roller bearing, the Roller Bearing Company of America (W. Trenton, N. J.) needed a proven, dependable oil seal of narrow cross section.

RBC engineers selected springless KLOZURE Model 71-A. They found this superior seal was specifically designed for limited space applications. In addition, Model 71-A had proved on thousands of applications that it would keep out dust and retain the lubricant for the *life of the bearing.*

Let us show you how Garlock KLOZURES can solve your sealing problems. There's a proven KLOZURE model for every bearing application.

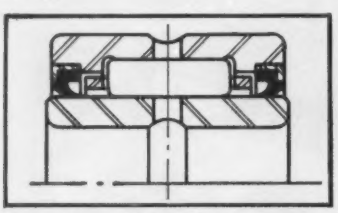
For full information contact the Garlock office nearest you or write for KLOZURE Catalog No. 10.

*Registered Trademark

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

Sales Offices and Warehouses: Baltimore, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, Los Angeles, New Orleans, New York City, Palmyra (N. Y.), Philadelphia, Pittsburgh, Portland (Oregon), Salt Lake City, San Francisco, St. Louis, Seattle, Spokane, Tulsa.

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.



Two springless KLOZURES, lips turned in, on "Pitchlign" bearing provide life-time retention of the lubricant.

RBC's new sealed "Pitchlign" roller bearing with two built-in springless KLOZURES.

GARLOCK

PACKINGS, GASKETS, OIL SEALS
MECHANICAL SEALS
RUBBER EXPANSION JOINTS

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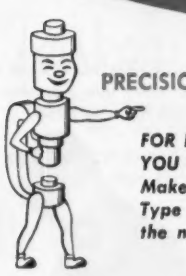
New 6" x 18" hand feed

Thompson Grinder

FOR SHOPWORK
OR TOOL ROOM

Completely anti-friction and permanently lubricated machine. Available with all types of attachments found on tool room surface grinders including interchangeable horizontal and vertical wheel heads. A Thompson high quality precision machine at this low price.

ONLY
$2,500*



PRECISION PETE says:

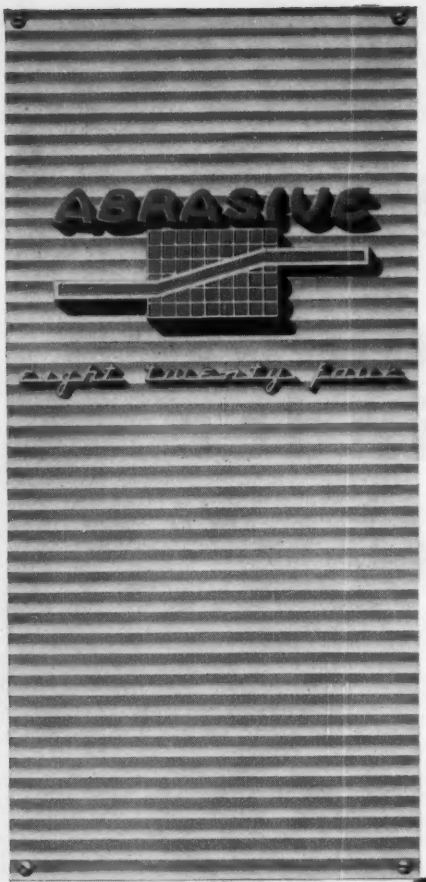
FOR LOW COST AND QUALITY YOU JUST CAN'T BEAT THOMPSON
Make your next hand feed grinder a Type D Thompson . . . write today for the new descriptive catalog, D-55

* Price F.O.B. Springfield, Ohio U.S.A., Subject to Change Without Notice.

Call, write or wire today

Thompson Grinders

The Thompson Grinder Company at Springfield, Ohio



You are going to see new things from ABRASIVE

The new Abrasive name plate above gives you a hint! In 1956, our fortieth anniversary, Abrasive will introduce a number of important developments in their well known line of surface grinders. For your greatest production year, keep your eye on Abrasive pioneering in 1956.

ABRASIVE
Machine Tool Company
Dexter Road, East Providence, Rhode Island

Sorry! We can't show this revolutionary new Abrasive in detail. Look for it in 1956.

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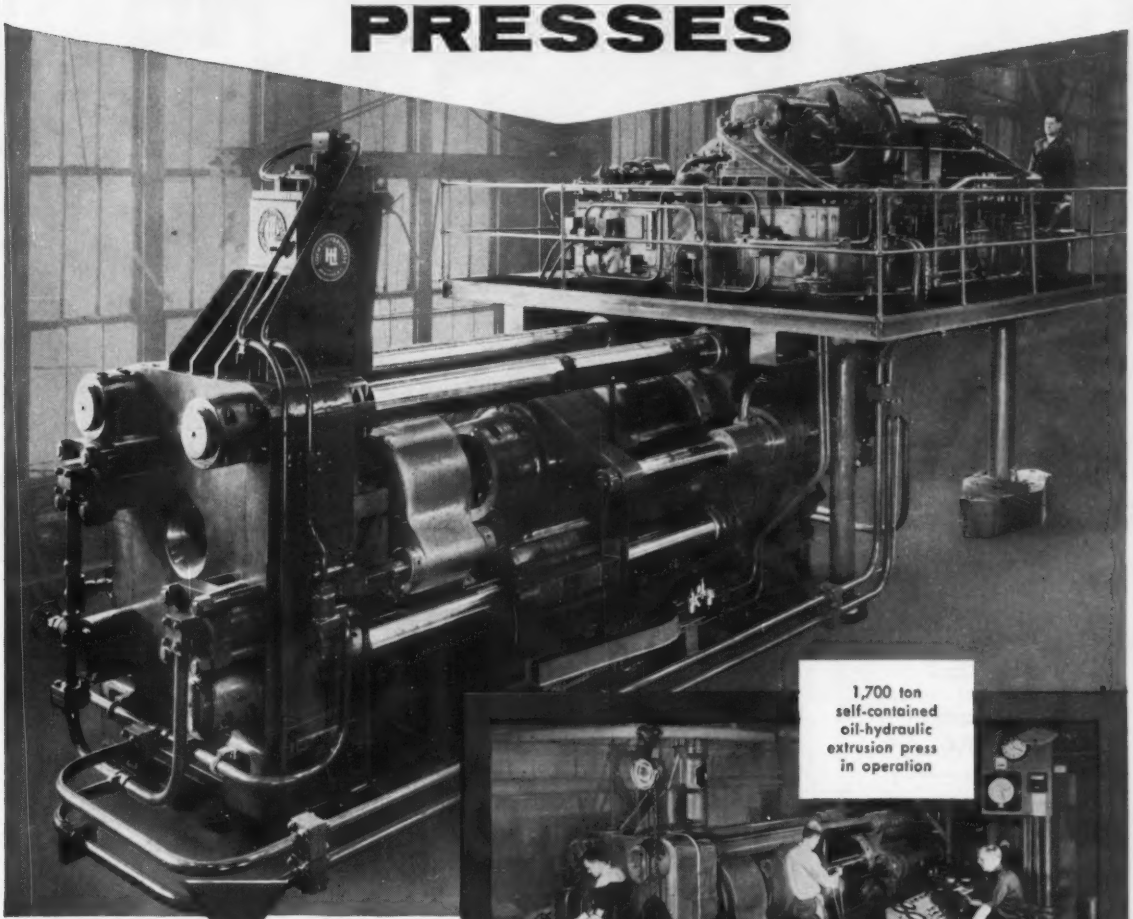
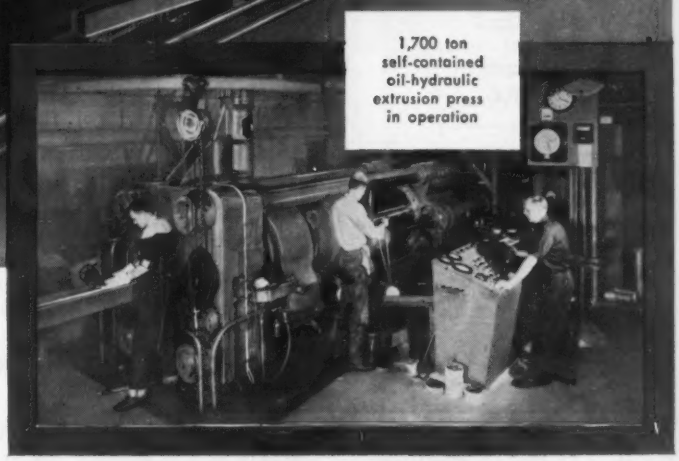
LOEWY HYDROPRESS

High-Speed, Oil Hydraulic

EXTRUSION PRESSES





1,700 ton self-contained oil-hydraulic extrusion press in operation

Package Unit

of 2200 ton capacity on the erection floor

Completely piped, wired and tested, prior to shipment

LOEWY HYDROPRESS INCORPORATED

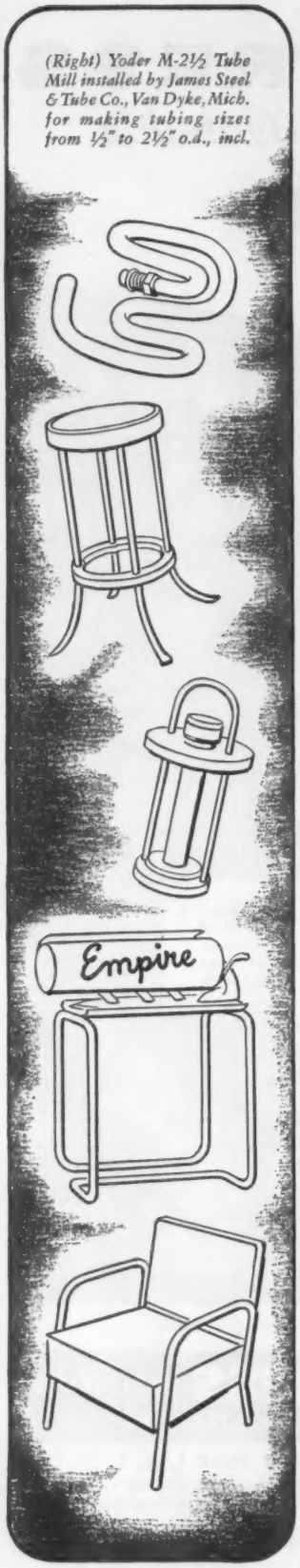
ENGINEERING • CONTRACTING

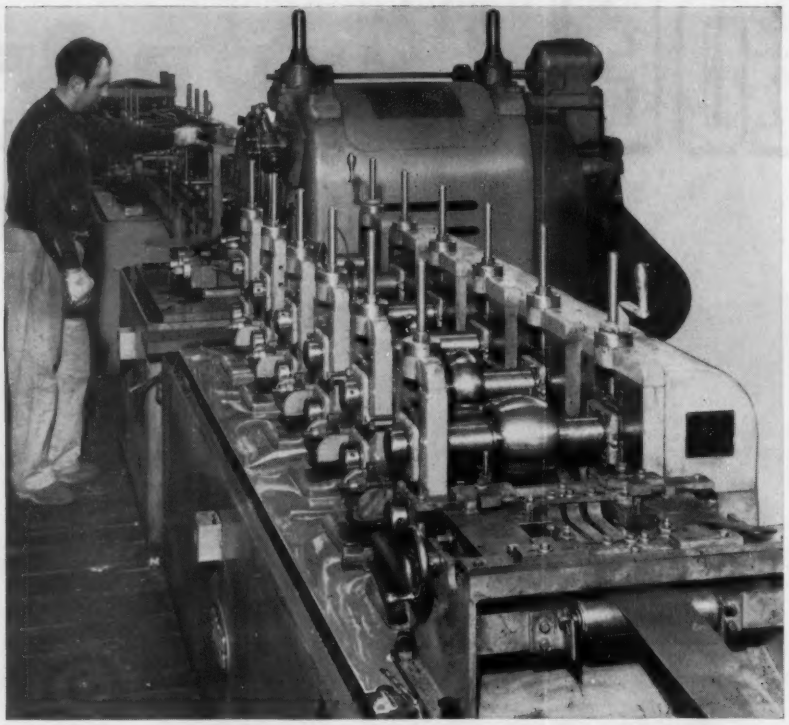
350-1 Fifth Avenue, NEW YORK 1, N. Y.

CHICAGO • CLEVELAND • LOS ANGELES • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • ST. LOUIS • WASHINGTON, D. C.
GENOA, ITALY • LONDON, ENGLAND • MADRID, SPAIN • PARIS, FRANCE • PHILIPPINE ISLANDS

Rolling Mills • Hydraulic Presses • Pipe Testing Machines • Special Pipe Mill Equipment • Accumulators • Pumps

(Right) Yoder M-2½ Tube Mill installed by James Steel & Tube Co., Van Dyke, Mich. for making tubing sizes from ½" to 2½" o.d., incl.





Plain Facts about

ELECTRIC-WELD TUBE MANUFACTURE

In tube making everybody wants the highest possible speed consistent with good, strong welds and dimensional accuracy. There are, in addition, at least three more essentials to profitable tube making, namely:

1. Low scrap losses—because cost per foot of strip metal is many times greater than the conversion cost.
2. Fine exterior finish, free from scratches, scuff marks and other irregularities which limit usefulness and lower salability.
3. Quick and easy mounting and adjustment of tooling, to reduce time losses between successive production runs.

Yoder tube mills excel in all these respects and have other mechanical, electrical and economic advantages. Because Yoder tube mill owners have found from experience their performance is as good as our promise, there are more Yoder mills sold and in operation than all other electric-weld mills combined. This is as true today as it was ten years ago.

If you want the plain facts about the things to look for in a tube mill, to insure most profitable operation over the years, the new Yoder Tube Mill Book will give them to you, in the simplest language and with numerous illustrations.

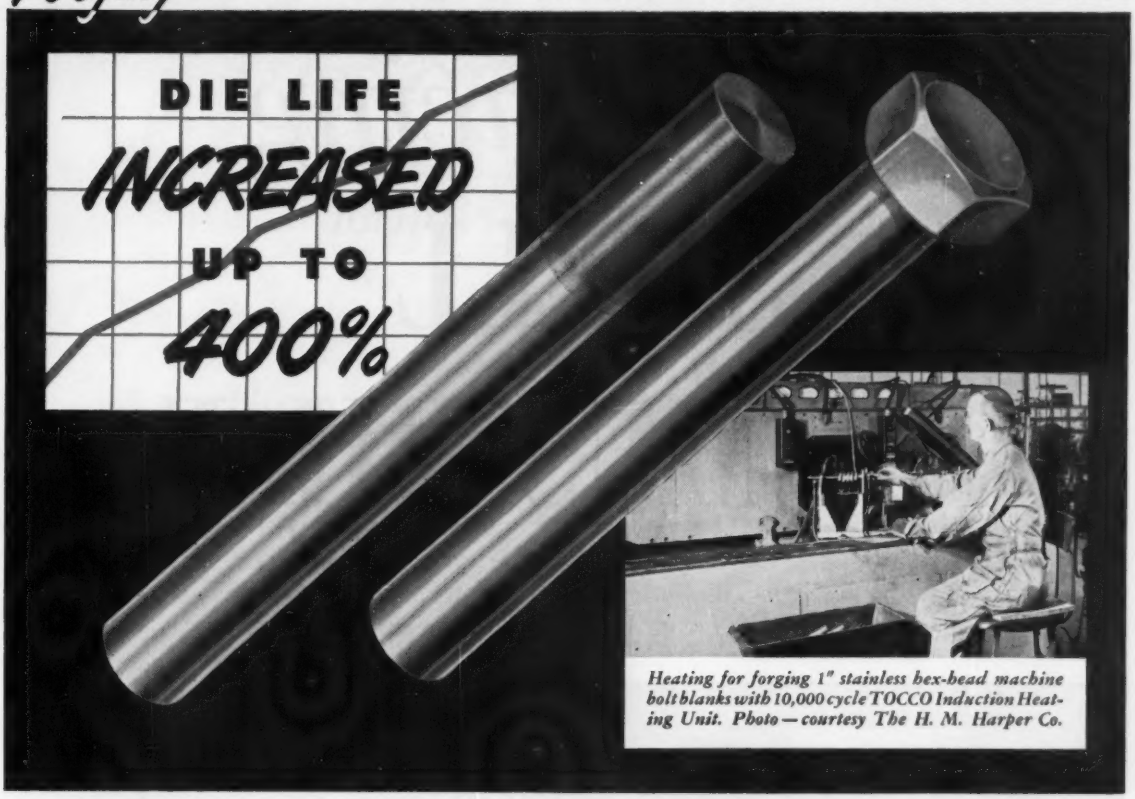
A copy is yours for the asking.

THE YODER COMPANY
5504 Walworth Avenue, Cleveland 2, Ohio

ELECTRIC-WELD TUBE MILLS • SLITTING LINES
COLD ROLL FORMING PRODUCTION LINES

INGENIERÍA YODER MANUFACTURA

Forging: COPPER • BRONZE • ALUMINUM • MONEL AND STAINLESS STEEL



Heating for forging 1" stainless hex-head machine bolt blanks with 10,000 cycle TOCCO Induction Heating Unit. Photo — courtesy The H. M. Harper Co.

with TOCCO* Induction Heating

● Naval Bronze, Silicon Bronze, Copper, Aluminum, Monel and all types of stainless steel are heated for forging at the H. M. Harper Co., Morton Grove, Illinois. Regardless of material TOCCO can be profitably applied to brazing, heat-treating and forging operations in almost any metal-working plant.

PRODUCTION UP—In addition to the very important savings in forging dies, TOCCO has increased production to as much as 265% of output possible with former heating methods. On the 1" type 303 Stainless machine bolt blanks shown here TOCCO upped production from 75 to 200 parts per hour, using 35 K.W., 10,000 cycles.

VERSATILE—The same TOCCO machine is used on stock of ⅛" to 1¼" diameter; heated zones vary from ½" to 4". TOCCO'S automatic timing cycles provide complete uniformity of heating throughout both length and cross section—assuring a uniformly high quality product.

●

Why not have a TOCCO Engineer investigate your plant to determine where TOCCO can cut your costs and streamline your production?

THE OHIO CRANKSHAFT COMPANY

TOCCO

Trade Mark Reg. U. S. Pat. Off.

Mail Coupon Today

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THE OHIO CRANKSHAFT CO.
Dept. M-11, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Heating for Forming and Forging".

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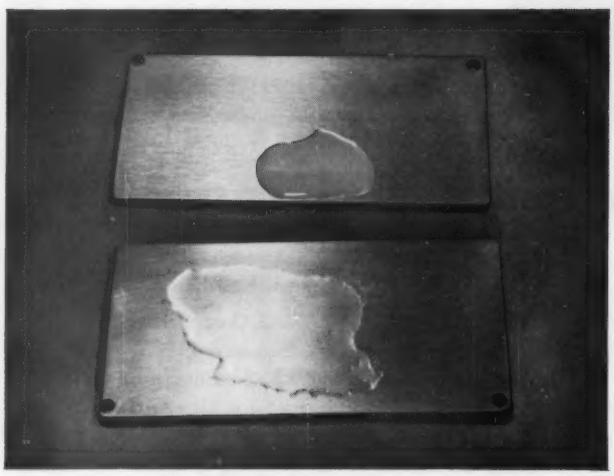
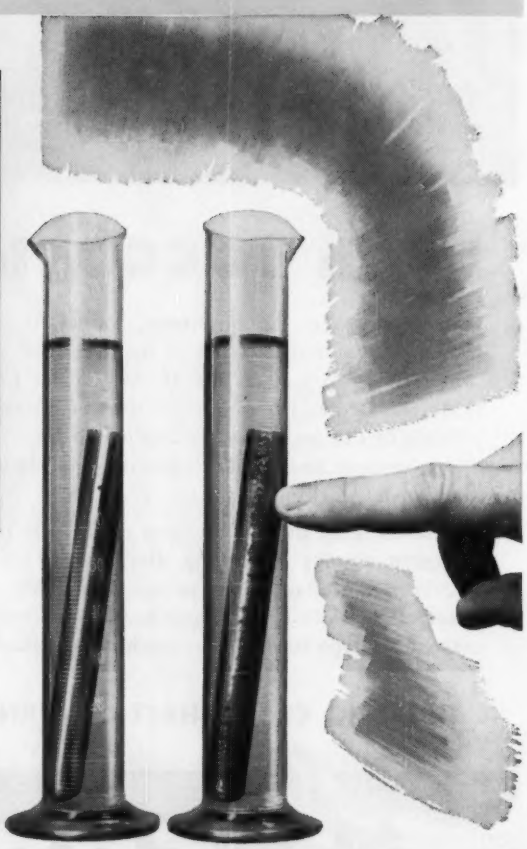
Announcing
SHELL
DROMUS OIL E





Above: Cooling action of a cutting fluid is directly related to its wetting ability. Conventional soluble oil emulsion (background) "balls" up. Equal amount of Shell Dromus Oil E spreads out thinly . . . wets far greater area.

Right: Plain carbon steel, if left in water at room temperature for about two hours, will rust as shown. Sample on left was in a 1-30 solution of Shell Dromus Oil E and water *for six months without rusting.*

SHELL DROMUS OIL E

NEW CUTTING OIL

permits higher speeds and faster feeds than ever maintained before

Shell Dromus Oil E, a new solution-type fluid, wets all metal surfaces with extreme rapidity and keeps both work and tools exceptionally cool. These qualities permit an increase of machine speeds and/or feeds far beyond anything allowable with conventional soluble oils.

IT'S MUCH EASIER ON TOOLS

There's much more life in any cutter or abrasive wheel when protected by this new oil. *It stays put* between tool and work. (At a 1-30 dilution, average tool life increase in extended field tests was about 50%.)

IT FIGHTS RUST

Shell Dromus Oil E is readily soluble in hot, cold, soft or hard water, and stable in any concentration. Even at low concentrations, it gives excellent rust protection to all ferrous metals, *including cast iron.*

IT KEEPS WORK COOL

Even at stepped-up production rates, you'll find less heating and better finish wherever this new oil is used.

IT SETTLES OUT FAST

Chips and wheel particles settle out immediately . . . the recirculated fluid is clean and free from contaminating particles. It is *not* sticky or greasy . . . leaves no deposits on machines or work.

IT'S GREAT FOR GRINDING

Grinding wheels remain clean, *even when material retains a film of cutting oil from a previous operation.* Even cast iron can be ground cleanly when Shell Dromus Oil E is used to cool the work.

If all this reads "too good to be true," we suggest that you try Shell Dromus Oil E *on any problem operation you have.* It *is* that good!

SHELL OIL COMPANY

50 West 50th Street, New York 20, New York
100 Bush Street, San Francisco 6, California

SHELL

for

VERSATILITY in GEAR MAKING

Spur
Helical
Spur Internal
Helical Internal
Racks
Herringbone
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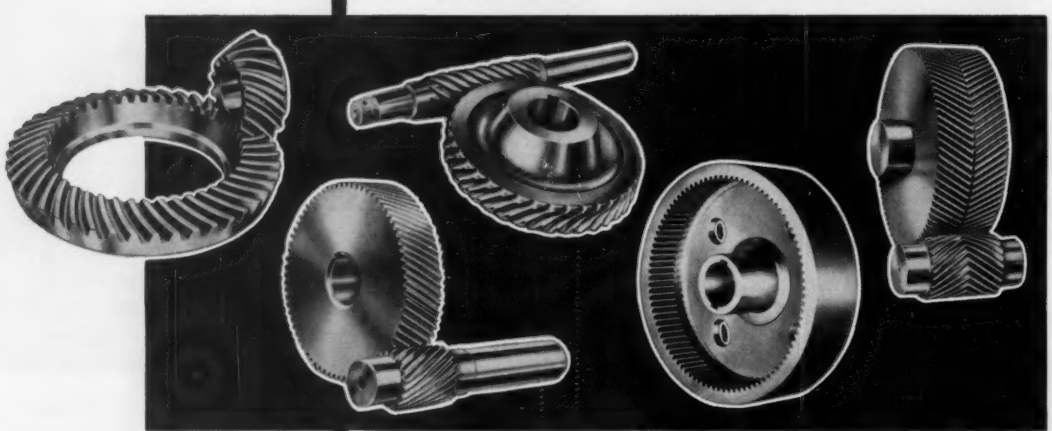
Non-Metallic
Spline-Shafts
Coniflex-Bevel
Spiral Bevel
Zerol
Hypoid
Intermittent
Sprockets

Consult PHILLIE GEAR®

Regardless of whether you require one or thousands of small Spur Gears . . . or a giant continuous tooth type Herringbone Gear . . . whether you want a bronze Worm Gear, or a huge internal Helical Gear . . . it's all the same to "Phillie Gear." Our Engineers and Gear Craftsmen are at your command, and they're backed-up by the very latest in gear cutting and finishing machines and methods . . . all operations are conducted in our two modernly equipped shops, under the supervision of experts.

On top of all this, you receive prompt, courteous service, plus delivery when and as you specify . . . and finally, you get the benefit of nearly 63 years continuous gear-making experience.



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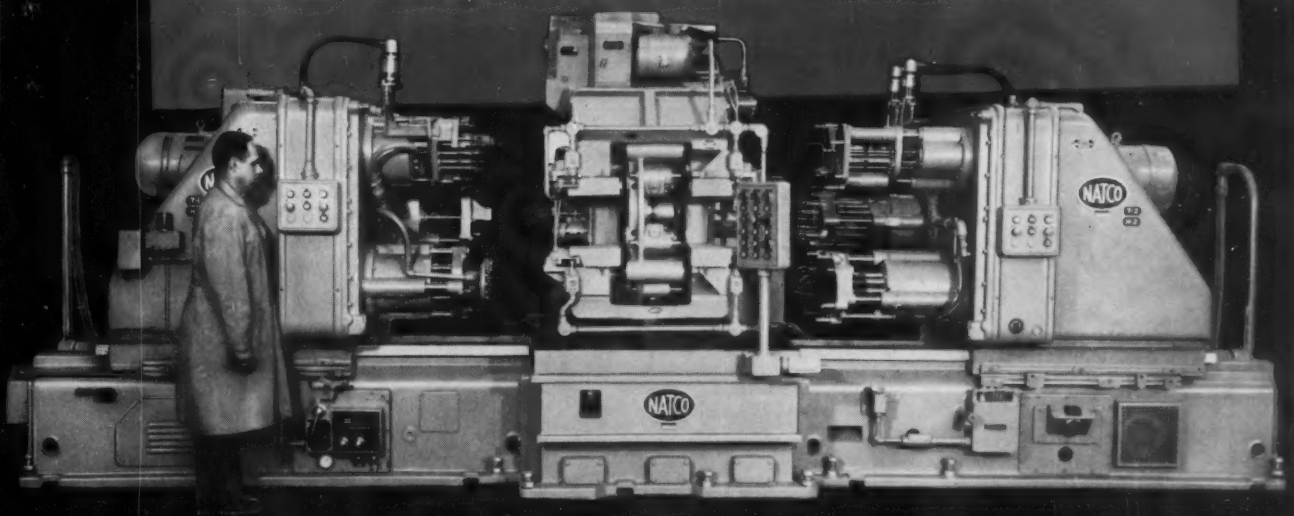
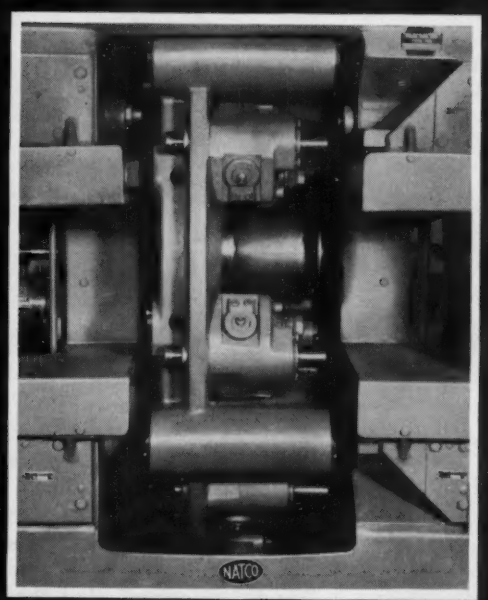
Industrial Gears & Speed Reducers • LimiTorque Valve Controls

Established 1892

COMBINING OPERATIONS on a NATCO Cut Costs and Increased Production!



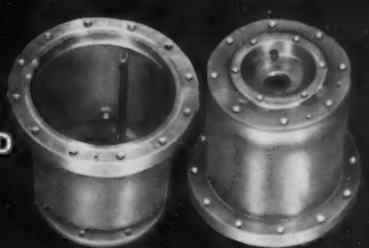


Close-up view of 6 position Trunnion Fixture

109 REFRIGERATOR COMPRESSOR SHELLS PER HOUR

Estimated Gross Production

DRILLED
COUNTERBORED
REAMED, TAPPED
CHAMFERED
BURRED



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NATCO

New High-Torque Unbrako self-locking socket set screws

set them, forget them—they stay tight

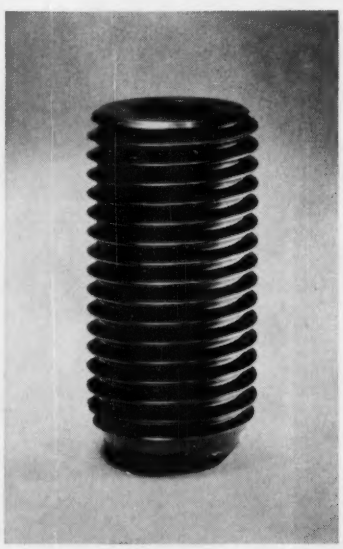
Up to 40% higher tightening torque—a new Unbrako feature

RECOMMENDED SOCKET SET SCREW TIGHTENING TORQUES
(Inch-Pounds)

SCREW SIZE	UNBRAKO	SET SCREW B	SET SCREW C	MINIMUM DIFFERENTIAL %
#4	5	3.9	3.5	28
#5	9	7.8	7.4	15
#6	9	7.8	7.4	15
#8	20	14.7	14.5	36
#10	33	26.5	25	25
1/4	87	62	60	40
5/16	165	122	125	32
3/8	290	198	225	29
7/16	430	309	350	23
1/2	620	460	500	24
5/8	1225	1106	1060	11
3/4	2125	1540	1800	18
7/8	5000	3660	4600	9
1	7000	5025	6500	8

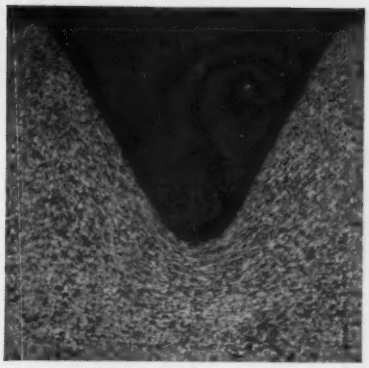
All UNBRAKOS can withstand higher tightening torques than ordinary set screws. For example, the recommended torque for a ¼" UNBRAKO is 87 inch-pounds —40% greater than that recommended for an ordinary set screw.

Research has proved that the tighter you seat a set screw the better it works. We went to work to design a socket set screw that could be tightened tighter than ever before without damaging the screw.



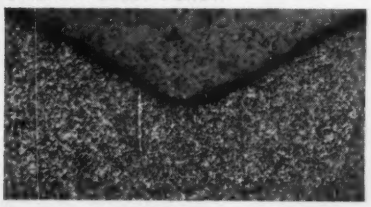
We formed a deeper socket. We put a radius in the socket corners. We developed fully formed threads. We established new methods of heat treatment in atmosphere-controlled furnaces. It took almost 6 years' research and development, but the new High-Torque UNBRAKO incorporates all of these improvements. And it retains the self-locking knurled cup point that keeps an UNBRAKO tight up to 48 times as long as a plain cup point set screw, regardless of the size of the point or the cup.

UNBRAKO SET SCREW



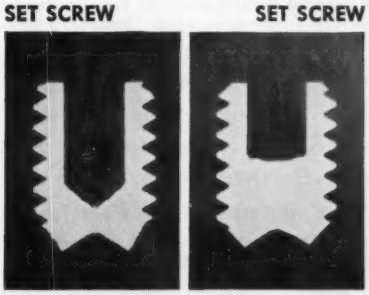
We fully form the threads—make the whole screw stronger. The metal is compressed into the closely knit grain structure that you see in this illustration. The grain flow follows the contour of the threads. There are no straight lines along which shear can occur. The UNBRAKO retains its flow lines even when ground down to .010" below root diameter. Screws with cut or ground threads lose thread form at root diameter.

UNBRAKO SET SCREW



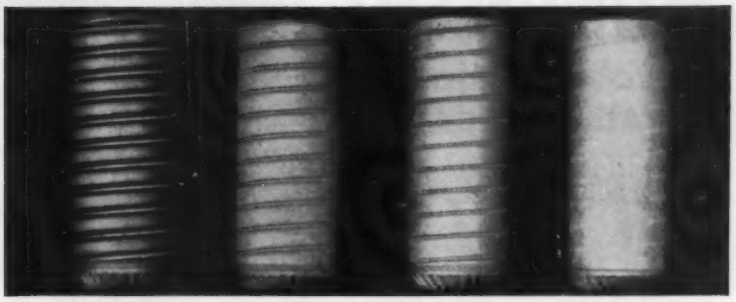
We put a radius in the socket corners—eliminate the sharp corners where cracks start. This distributes the stresses developed when tightening torques are applied. Ordinary socket screws have sharp corners which often crack when tightened even at lower recommended torques.

UNBRAKO SET SCREW **ORDINARY SET SCREW**

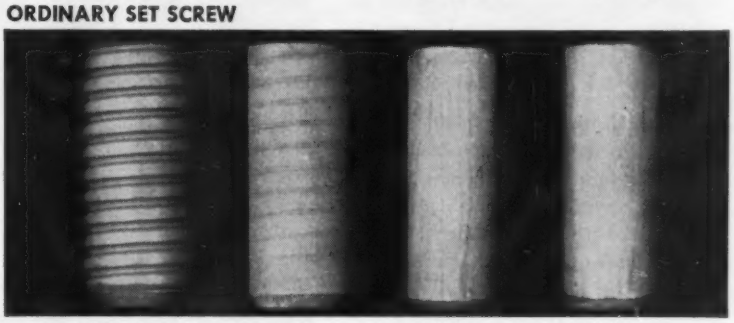


We form a deeper socket—give you more purchase with the wrench. Since more wrench can be put into the UNBRAKO socket, you can set the screw much tighter. And you won't ream the socket or round the corners of the wrench.

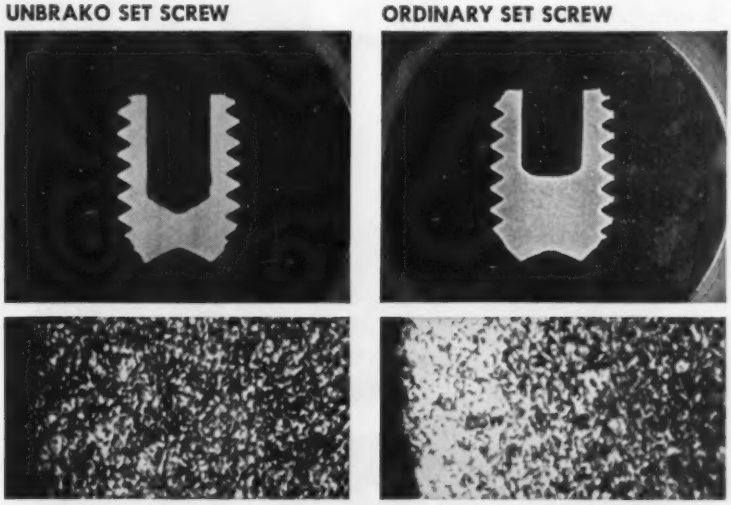
UNBRAKO SET SCREW



ORDINARY SET SCREW



UNBRAKO SET SCREW **ORDINARY SET SCREW**



We heat treat an UNBRAKO properly. It's a ticklish job to heat treat a socket set screw. If you don't do it just right, you get decarburization. And decarb plays havoc with a screw. Put a wrench in the socket and you ream it. Run the screw into a tapped hole and you strip its threads. Try to seat the screw and its point shears off. These photos show the good and the bad. The UNBRAKO is clean. Its grain structure is uniform. There is no decarburization—the ordinary screw is suffering from an overdose of it, socket walls, threads and point are full of the telltale white spots.

You can't buy another set screw as good as an UNBRAKO. See your authorized industrial distributor today. Or write STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION sps JENKINTOWN, PENNSYLVANIA

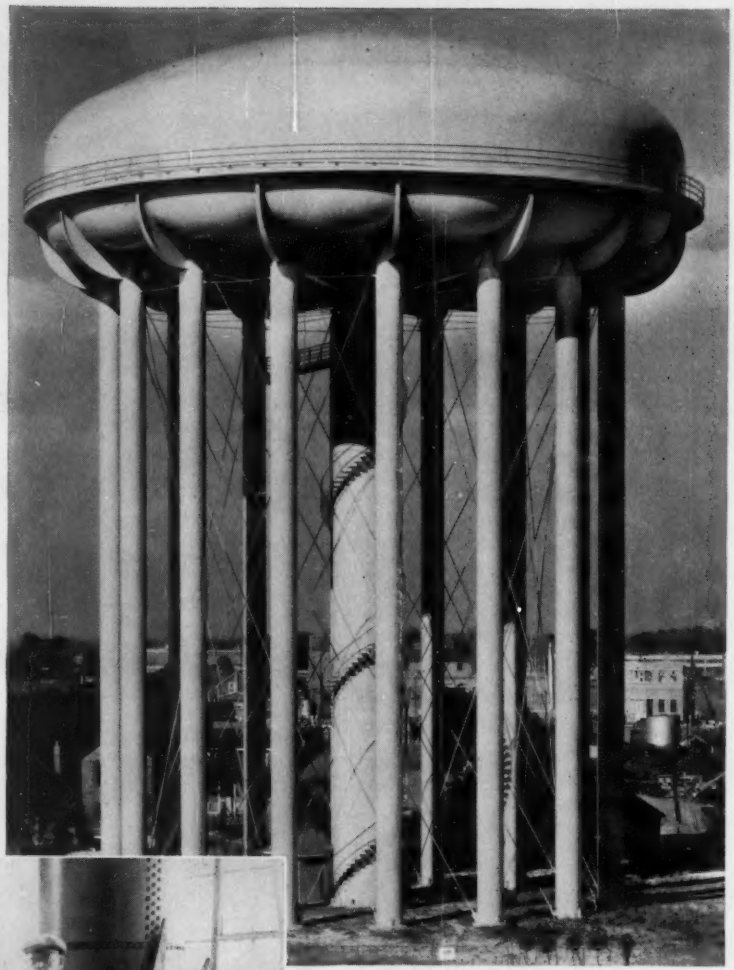
MONUMENT

TO PRECISION METAL FABRICATION

This 104-ft. diameter radial cone bottom elevated tank is indeed a monument to the engineering and fabricating ability of Horton Steel Works, Ltd., Fort Erie, Ontario. The huge structural members, including a framework of angle-iron rings for the tank roof, were precut and formed in the Horton shops to fractional-inch tolerances for on-site assembly.

The rings, which are welded to the underside of the roof plate, were accurately and rapidly shaped to the curve of the roof by "Buffalo" Bending Rolls like the one shown below. Horton uses one of these machines in its Fort Erie plant to form the curved angles used in Horton tanks.

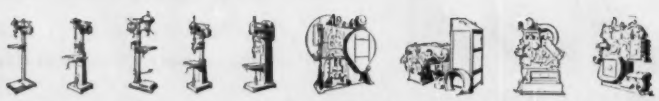
If you bend structurals, do it the accurate, high-speed way used by industrial leaders — with "Buffalo" Bending Rolls.



"Buffalo" BENDING ROLLS

— like this No. 3 Horizontal Roll at the Horton plant, turn out commercially perfect circles, spirals, arcs and other shapes from most structurals, at production-line speeds. A full range of "Buffalo" Horizontal and Vertical Bending Rolls is available for your heavy structural forming — while "Buffalo" Pinch-Type and OA Aircraft Type Rolls are ready to cut your costs on bending light members. Write today for Bulletins 3344-A and 352-C.

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.



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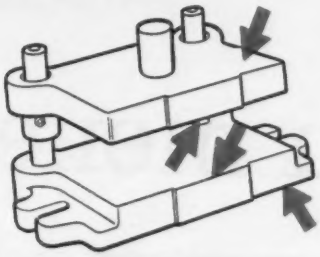
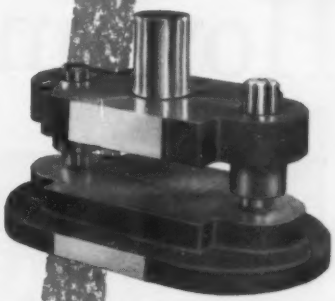
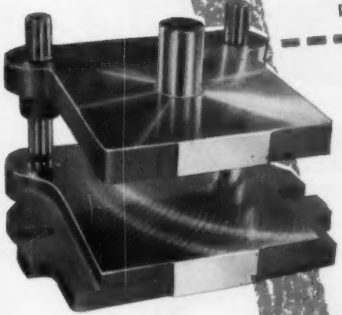
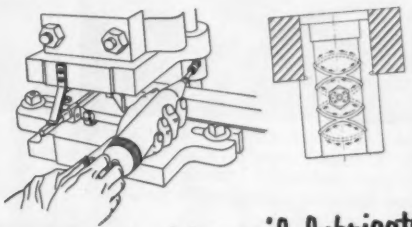


all horizontal surfaces ground

Now, in addition to the vital die surfaces of all steel or semi-steel sets, all horizontal surfaces, including tops of punch holders, are ground with the same precision that has made Danly quality the accepted standard. Surface grinding assures a flat, true working surface, saves tooling time and improves accuracy.







Shoulder bushings oil lubricated

All Danly Standard Sets equipped with shoulder bushings are designed for easy, pressurized oil lubrication. Fittings in bushing shoulder are easily reached from front or side. Cut-away sketch shows oil channels in bushing that form lubrication reservoir for long runs and maintain oil film with a minimum of clogging or gumming.

New features like these keep DANLY ahead

Throughout the years, the rigid precision standards of Danly have made Danly Die Sets the recognized standard for quality. Now Danly Die Sets offer you two new features to save hours in the die shop, make tooling-up much faster and assure longer die life. All new Danly Die Sets have an oil lubrication system for shoulder bushings and all horizontal surfaces are ground to assure a true working surface for die making. Danly's nationwide system of assembly branches is ready to serve you. Call Danly today.

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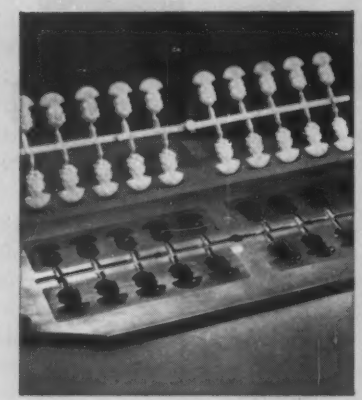
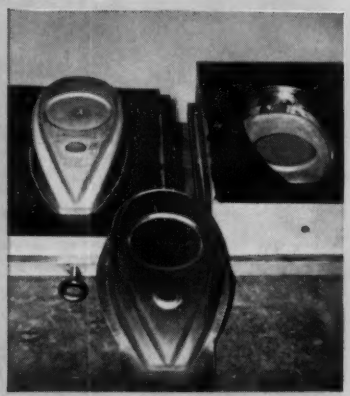
DANLY

How much money can



Injection molding dies of Epon resin (left) reduce costs 80% for Adams Plastic Products, Cincinnati, Ohio. Duplicate patterns (center) are made to close

tolerances with Epon resin by Crane Company, Chicago, Ill. Epon resin dies for outboard motor housing (right) are one-third cost of comparable metal dies



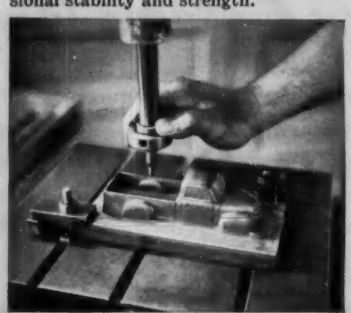
for Clinton Machine Company, Maquoketa, Ia. Formulations for these three applications supplied by Kish Industries, Inc., Lansing, Mich.

Epon resin gives you these advantages for making tools and dies . . .

- Cast and cured at room temperature . . . no special equipment needed
- Cast to close tolerances . . . less machining and handwork
- Easily duplicated and altered . . . short production time

Epon resins are the epoxy polymers made exclusively by Shell Chemical Corporation.

Epon resin stretch dies developed and used by Lockheed Aircraft Corporation, Burbank, California, show high dimensional stability and strength.



Toy models of Epon resin made by Ber-Design Associates, Irvington, N.J., stand up in duplicating machine during hob-making process at Columbia Engineering Company, Newark, N. J.

you save using

EPON® RESIN

to make TOOLS and DIES?

New resin can reduce tool production costs by 80%

PLASTIC TOOLING now has graduated from the short-run experimental stage to the profitable production stage . . . thanks to the unusual physical properties of Epon resin.

Saves time and labor

Little machining and handwork are required to finish Epon resin tools, dies, and patterns, because the material can be cast to very close tolerances. No specialized equipment is needed, because Epon resin tools are cured at room temperature.

Tools resist wear

Other advantages of Epon resin tools are that they withstand great pressures, are unaffected by chemicals and a wide range of temperatures, and maintain a high resistance to abrasion and corrosion.

Where Epon resin tools are used

Draw dies, drop-hammer dies, and injection molding dies for polystyrene . . . are some of the Epon resin tools now serving a variety of industries. Drilling, welding, routing and checking fixtures, foundry patterns, and vacuum-molding dies . . . all made of Epon resin, are also in daily production.

Find out more

Savings of 80% over the cost of comparable metal tools have been reported by tool- and die-makers. How much can you save in your operations? Best way to find out—write for technical literature on the use of Epon resin in tool and die applications.

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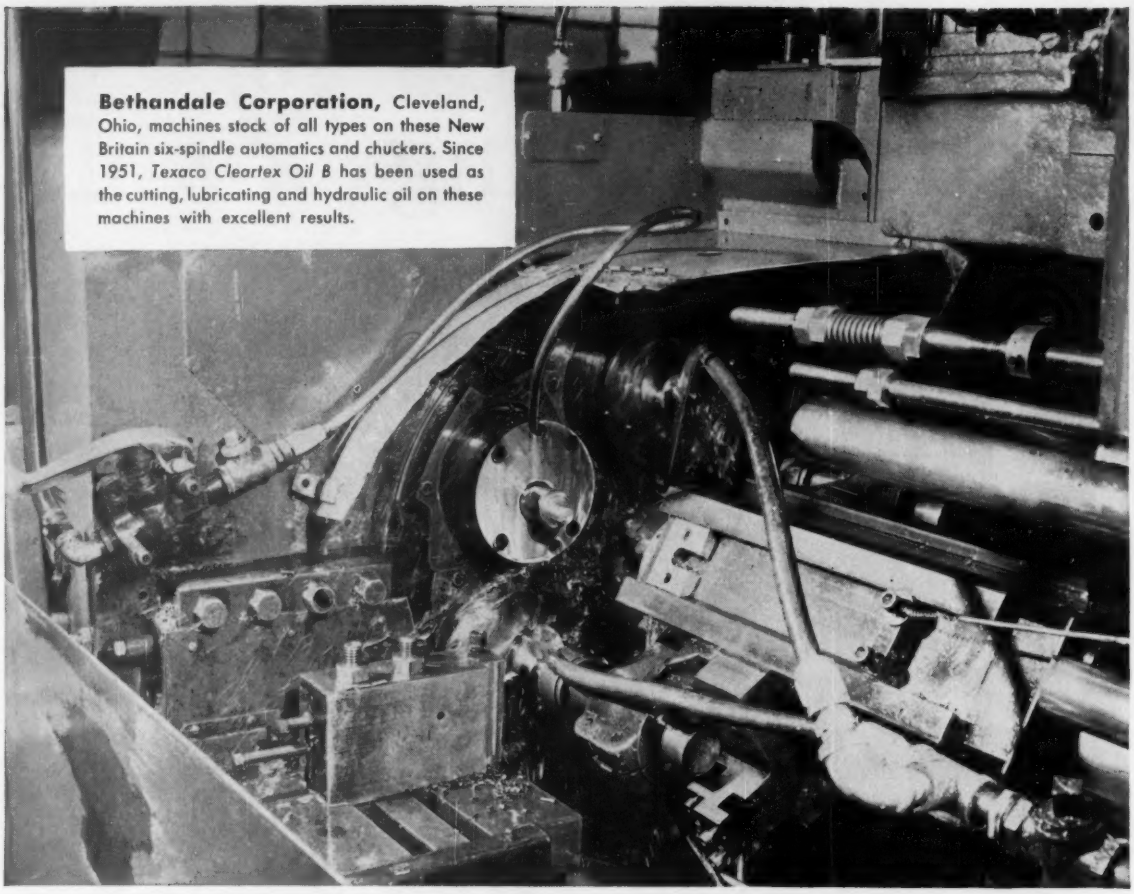

Bethandale Corporation, Cleveland, Ohio, machines stock of all types on these New Britain six-spindle automatics and chuckers. Since 1951, *Texaco Cleartex Oil B* has been used as the cutting, lubricating and hydraulic oil on these machines with excellent results.

"We put our stock in Texaco"

Bethandale Corporation, Cleveland, Ohio

THIS JOB SHOP performs a wide variety of cutting operations on all types of steel and non-ferrous materials. Four years ago, they began using *Texaco Cleartex Oil B* in their automatics, as cutting, lubricating and hydraulic oil. And here's what they say about it:

"We like *Texaco Cleartex Oil B* particularly because of its tri-purpose features and its versatility. We can use the one oil on steels, brass, other metals —even copper—and be sure of excellent finish, long tool life, and no corrosion. And the fact that *Texaco Cleartex Oil B* keeps the lubricating sides of our automatics clean means a savings in maintenance costs."

Texaco Cleartex Oil B is one of a complete line of *Texaco Cutting, Grinding and Soluble Oils.* Whatever the stock, however you machine it—there's one of these superior oils exactly right to assure better, faster machining at lower cost.

To help you select the proper one, consult a Texaco Lubrication Engineer. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

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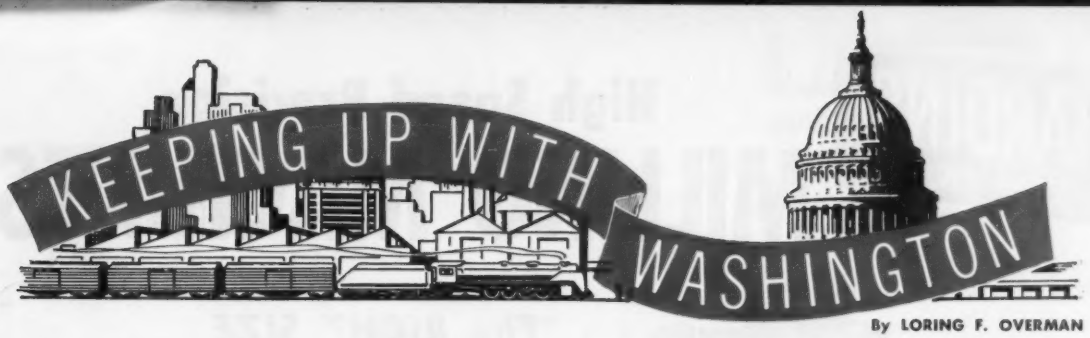

By LORING F. OVERMAN

Service Requests for Machine Tools Exceed Available Funds

Mobilization Base

Just prior to President Eisenhower's illness, the Office of Defense Mobilization had announced plans to discontinue further expansion of many of its production goals. Typical of this were decisions to bar further Government aid for the expansion of basic steel and aluminum capacity. In both cases, the Defense Mobilization Board decided that present or anticipated capacity appeared sufficient to meet all foreseeable needs. Defense Mobilization Director Arthur S. Flemming said that the aluminum goal, calling for an annual capacity of 1,746,000 tons by 1955, will have been exceeded by 32,000 tons when capacity planned or under construction is completed.

The steel goal, which was originally 124,300,000 net tons annually, has now been exceeded, but industry favors further expansion. Capacity can be expanded, but not with the encouragment of rapid tax amortization previously offered. Further study of pig iron supplies is under way, but expansion is doubtful. Closing of expansion goals is also in prospect for electrolytic tinplate, iron ore, by-product coke, and metallurgical coal.

Machine Tools in the Middle

With the Government applying brakes to defense expansion, machine tool builders are somewhat in the middle. The Federal Reserve Board report observes that the first half of 1955 was a period of advancing profits for large corporations. The machinery industry, however, showed less expansion than most of the durable goods industries. Sales and profits were relatively stable. In the second quarter, sales were about 5 per cent above last year, with profits up 13 per cent. Sales of durable goods in general moved up 23 per cent during the period.

Machine Tool Reserve

Requests by the Navy and the Air Force for a share of the second year's $100,000,000 allotment of machine tools for the mobilization reserve, are said to far exceed the total funds available. Both requests will be scaled down upon receipt of the Army estimate of requirements. Both the Navy and Army are reported to have obligated their shares of the first year allowance of $100,000,000. The Air Force, with the lion's share ($84,000,000) is expected to complete its contracting by the end of 1955.

Foreign Machine Tools

A study of Government procurement of foreign machine tools has been ordered by Mobilization Director Flemming. The investigating committee will include representatives of the Departments of Defense, Commerce, Interior, and State; the General Services Administration and the Small Business Administration. The official text of Director Flemming's announcement reads: "There have been several recent instances of Federal procurement of machine tools from foreign producers which have caused considerable concern both in Government and industry. Comments from industry suggest that these procurements should have been rejected under Section 3(d) of the President's Executive Order 10582 and in furtherance of the reserve tool and facilities program. In these particular cases, the items were not ones included in the tool program, nor does it appear that they should have been rejected under Section 3(d).

"However, there are important issues involved which have led me to the decision to establish an interagency group to study the questions and recommend the best guidelines for appropriately relating the tool program to the procedures set forth in the Executive Order."

Air Force Program Stabilized

Encouraging news of increased sales possibilities for machinery producers may result from the currently stabilized aircraft program. New policy directives intended to give the Air Force better values, may also result in modernization of the plants and equipment serving the aircraft industry. Expenditures for aircraft of between $6,000,000,000 and $7,000,000,000 yearly are forecast for 1956 to 1959 inclusive, by Major General David H. Baker, Director of Procurement and Production, Air Material Command, Wright Patterson Air Force Base. The stabilization, General Baker said, will be accompanied by changes in types of procurement, as well as in methods. There will be more guided missiles and fewer air frames; more electronics and fewer mechanical armament items.

Changes in contracting will include greater competition between contractors, and a trend toward fixed prices. The stepped-up competition is the one expected to involve plant improvement. "One incentive to modernize plants," said General Baker, "will be to reduce costs in order to meet competition. Another incentive is the recently approved depreciation methods which, in some instances, provide up to 70 per cent write-off of purchased machinery in about half of its physical life.

"We may find," the General continued, "that we also have the job of seeking the revaluation by the Treasury Department of estimates of depreciation life of some manufacturing equipment to take into account the rapid loss in economical usefulness. Through these means, as well as others, we must prevent the equipment obsolescence which will otherwise occur with our high stabilized production program."

Washington Briefs

Steam Turbine Gear Capacity—A $70,000,000 program to round out capacity to produce steam turbines and turbine gears required for defense mobilization has been authorized by the Director of Defense Mobilization. A list of machine tools and equipment required for the program was developed a year ago and is being reviewed by the Department of Defense, Department of Commerce and Defense Services Administration.

Machine tools not in the Government-owned reserve industry will be purchased. All will be installed on a stand-by basis in the plants of eight companies having production capacities in this field. Cost of purchasing the equipment will be borne by the revolving fund provided under the Defense Production Act. The turbine and turbine gear program is the first in which the Government will finance directly an increase in capacity for critical components. The eight companies in which the equipment will be installed are: Allis-Chalmers Mfg. Co., DeLaval Steam Turbine Co., Elliott Co., Falk Corporation, Farrel-Birmingham Co., General Electric Co., Newport News Shipbuilding & Drydock Co., and Westinghouse Electric Corporation.

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Eight Spindle Speeds —
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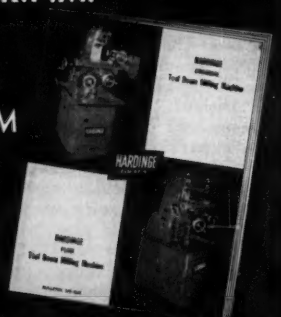

Model UM Universal Spiral Miller
Model TM Universal Plain Miller

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MACHINERY
NOVEMBER 1955

Isotopes in the Machine Shop

Whenever nuclear energy is mentioned, the average person immediately thinks in terms of atomic and hydrogen bombs and the horrendous devastation of which they are capable. Fortunately for humanity there has been within the last few years considerable progress in agreements entered between countries for co-operation in developing atomic energy for peaceful purposes. If some day all the nations of the world show sanity in the solution of conflicting problems, atomic energy can become an inestimable boon to mankind instead of a terrible scourge.

Radio-active isotopes that are a by-product of nuclear energy are already being widely used in medicine for the alleviation of human ills. They also have been applied in the chemical industry for the solution of hitherto insurmountable problems. Now they have found their way into the machine shop as indicated by the leading article in this number of MACHINERY.

Isotopes are two or more forms of the same element that have the identical atomic number and are closely similar in chemical behavior. They are distinguishable by differences in atomic weight and other phenomena. According to present theory the nuclei of isotopes contain the same number of protons but different numbers of neutrons.

One of the reasons that certain sections of the country are being scoured by scientists and amateurs with Geiger counters in the search for uranium is because that element is radio-active and most desirable for atomic energy applications. The atom of uranium is nature's heaviest and is estimated to consist of 92 protons and 146 neutrons.

From their energy radiations it is easy to determine the location of radio-active isotopes in any mixture that includes these irradiated particles and to ascertain the intensity of their radiation. In the research program described in the article referred to, the wear of irradiated carbide tool tips is determined by measuring the intensity of the radiation emanating from exact quantities of chips obtained in turning tests performed on a turret lathe. Minute radio-active particles of carbide fall with the chips into a pan as the tool wears. It is believed that eventually it will be possible to predict the ultimate life of a typical carbide tool tip by taking a single cut with a comparable radio-active tip under the same working conditions.

Other applications of radio-active isotopes toward solving the problems of the metal-working industry can well be anticipated. They will constitute further examples of applying the wonders of science at the practical level of the shop.

Charles O. Herb

EDITOR

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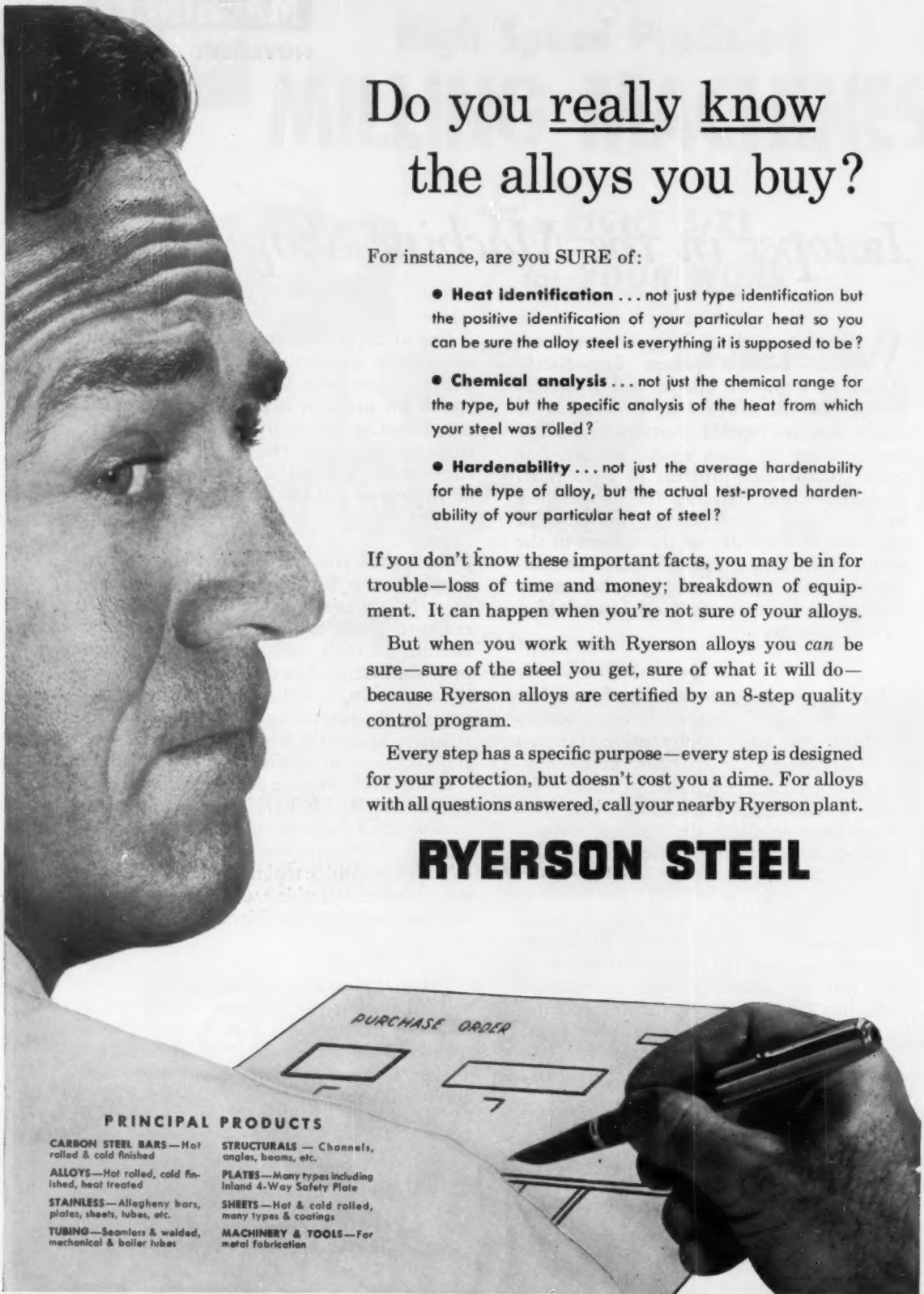

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RADIO-ISOTOPES

measure tool wear in metal-cutting

By ROBERT T. HOOK
Chief Metallurgist
Warner & Swasey Co.
Cleveland, Ohio

THE cutting tool is a most important governing factor in machine tool development. It would be purposeless to build into a machine a capacity for taking cuts beyond the potentialities of the tools that will be used when the machine is placed in service. Conversely, as cutting materials continue to be improved, machine tool builders must redesign their models to take full advantage of such improvements.

At the Warner & Swasey Co. a constant study of cutting tool materials is considered imperative to provide a guide for always designing the turret lathe of tomorrow. Through the use of special machines and instruments in the laboratory, an attempt is made to determine as closely as possible the effect of speed, feed, depth of cut, and cutter design on machine horsepower requirements and on cutter life. Progress in this research work has resulted in the development of numerous practical carbide cutting techniques

Fig. 1. Whenever radio-active materials are removed from the special lead-lined storage vault, a technician measures the radiation intensity to determine the safe working distance.

that are in use today throughout the metal-working industry.

Such experimentation, however, has been expensive and time-consuming and, occasionally, hampered by the lack of sufficiently accurate testing methods. The company decided to take advantage of new methods opened up by the advent of radio-isotopes as a by-product of the Government's Atomic Energy Program. Radio-isotopes have provided research technicians in the field of medicine, science, and various branches of industry with valuable new means for exploring and solving difficult problems. Warner & Swasey Co. is not the first in the machine tool industry to employ radio-isotopes in research but is among the first to apply radio-active carbides to basic experiments in metal-turning.

The decision to incorporate radio-isotopes into the research program was based primarily on two important conclusions. First of all, from data available on the use of isotopes in other fields it seemed obvious that radio-active materials would provide a test method that would be faster, more accurate, and cheaper to apply than any method that had been used up to that time. Secondly, the possibility of using isotopes for future research in various phases of machine design, as well as metal-cutting, indicated the advisability of bringing radio-active materials into the plant without delay.

The first problem encountered in establishing a nuclear energy laboratory was that of changing the regular metal-cutting test facilities to conform with the strict regulations of the Atomic Energy Commission. Valuable instructions in the use of radio-active materials were obtained from the director of the radio-isotope laboratory at the Case Institute of Technology.

The Warner & Swasey laboratory was located on the second floor of the main plant building adjacent to the demonstration room and regular manufacturing areas. This location was chosen so that visitors to the demonstration room could be shown the facilities available for research in metal-cutting. It also enables utilization of the heavy equipment stationed in manufacturing areas for moving machines and work stock into and out of the laboratory.

The laboratory room measures 25 by 30 feet and has a 10-foot high ceiling. All cracks in the walls were tightly sealed, and the walls and ceiling painted to obtain a light, easily cleaned surface. Two banks of tubular lights were installed to supplement the natural daylight that is provided by four windows located high on the north wall. The existing floor was replaced by one of asphalt tile. The areas of radiation danger, such as the area around the storage vault, are indicated on the floor in red tile. A tile floor was chosen because it can be easily taken up for cleaning in the event that radio-active substances should be accidentally dropped. The laboratory is large enough to accommodate two turret lathes and all necessary instruments, machine attachments, and other test apparatus.

The Atomic Energy Commission required the provision of both a shipping container and a storage vault for the "hot" materials. The shipping container, built for accommodating only two or three small carbide cutting tips, weighs over 600 pounds. It is constructed of steel plate and lined with 5 1/2 inches of lead all over. This shipping container is seen on the skid at the right in Fig. 1.

The storage vault is also constructed of steel plate and lined with lead. It has a refrigerator type door that can be locked when the contents are not actually in use. The vault is seen at the left in Fig. 1 with the door open. Only one person in the entire company is authorized to open this vault and it is his responsibility to see that all "hot" materials are returned to the vault at the end of each day and that the door is locked.

There was a problem involved in overcoming the fears of personnel who would either be directly or indirectly connected with the handling of the radio-active materials. It was only natural that people who have read of the power of atomic and hydrogen bombs and radio-active fall-out would have a deep fear when suddenly confronted with radio-active materials at their place of employment.

Lectures on the handling of radio-active substances were, therefore, given by the director of the Case radio-isotope laboratory to all foremen in charge of any department in the vicinity of the Warner & Swasey laboratory and in the shipping and receiving departments. Any questions were answered to the full satisfaction of the individual person. As a result of this careful preparatory work, there has not been a single complaint concerning the use of isotopes in the plant during a year of experiments.

Every person who actually works in the laboratory has been provided with a film badge that must be worn at all times when radio-active materials are being used. From the amount of exposure of the film in a badge over a specific interval of time, the radiation dosage of the wearer can be computed. If a check should happen to indicate that an individual is getting anywhere near the critical exposure point, he would immediately be directed to discontinue participation in experiments for a period of time, the length of which would be governed by his degree of exposure. To date, no one working in the laboratory has come anywhere near the maximum allowable exposure.

In order to obtain final approval of the laboratory facilities from the Atomic Energy Commission, it was necessary to purchase approximately $1500 of special instruments. Oddly enough the cost was considerably less than the previous investment in regular mechanical instruments. The new instruments include a Geiger counter for use in monitoring the laboratory and for clean-up purposes; a detector known as a "Cutey-pie" for determining the safe working distance when handling "hot" materials; and a precision rate

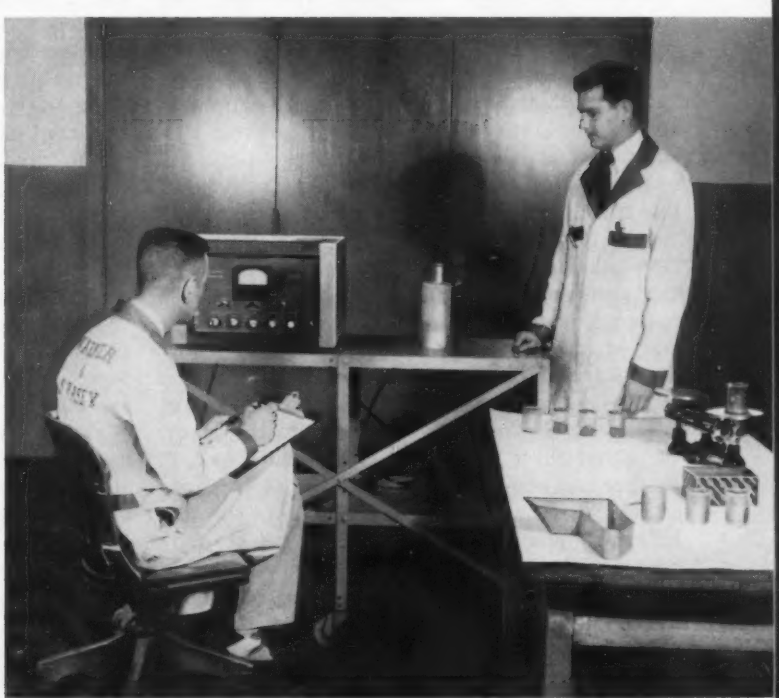


Fig. 2. The radiation intensity of 50 grams of metal chips produced by a radio-active carbide tip is determined by means of a precision rate meter.

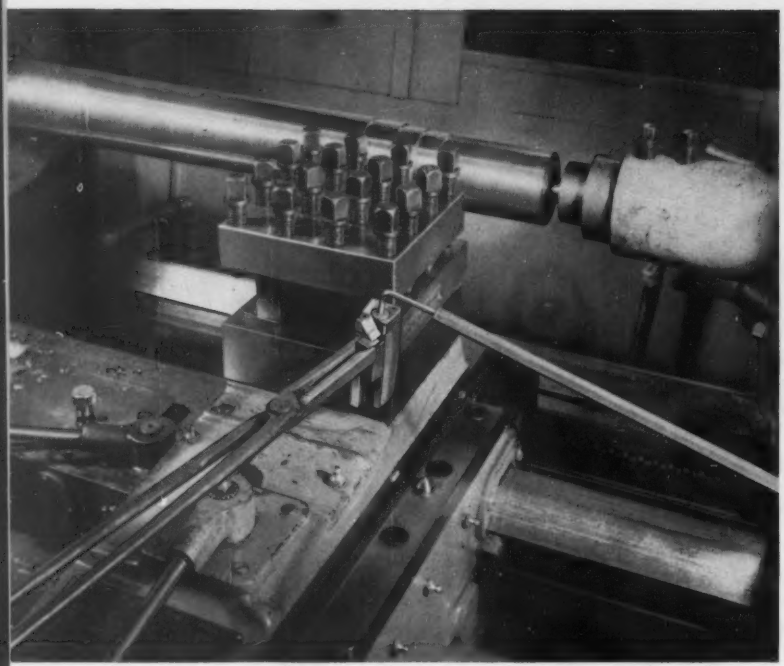


Fig. 3. In mounting a radio-active carbide cutting tip on a special clamp-on cutter holder, long-handled tools are used to enable the technician to remain at a safe working distance.

meter for accurately measuring the radiation intensity of test samples of metal chips. The Cutey-pie detector is seen in the hands of the laboratory technician at the left in Fig. 1. The rate meter is shown on the table in Fig. 2.

Once the laboratory was outfitted and approved, carbide cutting tips were shipped to the Brookhaven National Laboratory for irradiation in the atomic pile. The carbide tips were precision-ground, standard grades, and measured 1/2 inch square by 3/16 inch thick. Prior to being shipped, each tip was wrapped in aluminum foil to facilitate handling, and to prevent discoloration and burning during irradiation.

Irradiation service normally covers a period of one week. Because of the extremely high radiation of the tungsten 187 isotope contained in the tips following irradiation, the tips were kept on the grounds at Brookhaven Laboratory in the shipping container for about ten days. At the end of that time the radiation intensity had dropped to within the safe limits.

The "hot" carbide tips remained in the vault at Warner & Swasey, after delivery to the plant, for about three weeks until they had "cooled" further and stabilized themselves at a lower rate of activity. The tungsten 187 isotope in the carbide tips has a half-life of only twenty-four hours, so that after a period of a few weeks only the cobalt 60 isotope and the tungsten 185 isotope are the active elements usable for test purposes. After the cooling-off period, the tips were removed from the vault and the aluminum foil wrapping discarded. Special tongs fabricated by a blacksmith and having 4-foot long handles were used to unwrap the tips and move them about. These tools are seen in several views.

Currently the machine on which tests are being conducted with the radio-active carbide tips is a standard 2A extra heavy-duty turret lathe. The machine is equipped with special sheaves to permit cutting speeds higher than standard. Cutting tests are conducted in a manner similar to that followed in ordinary tests with the exception that a radio-active carbide cutting tip is used in place of a conventional tip. A clamp-on cutter holder of the type seen in Fig. 3 is employed to mount the radio-active tip on the machine. This must be done at a distance of several feet to insure the safety of the technician and so it is accomplished by applying a long-handled tong. A long bar is used for tightening a socket-head screw.

Tests are run under various conditions of speed, feed, and depth of cut. As the cutting tip wears, minute quantities of radio-active carbide are transferred from the tip to the chips. The quantity is directly proportional to the wear that has occurred on the tip. By collecting these chips during a cutting test and measuring their radiation intensity with the precision rate meter, a definite value can be determined for plotting on a graph. A small pan positioned under the cutter by the operator, as seen in the heading illustration, catches the chips. Although all chips do not fall into this pan, the final reading is not affected because a sample of chips weighing exactly 50

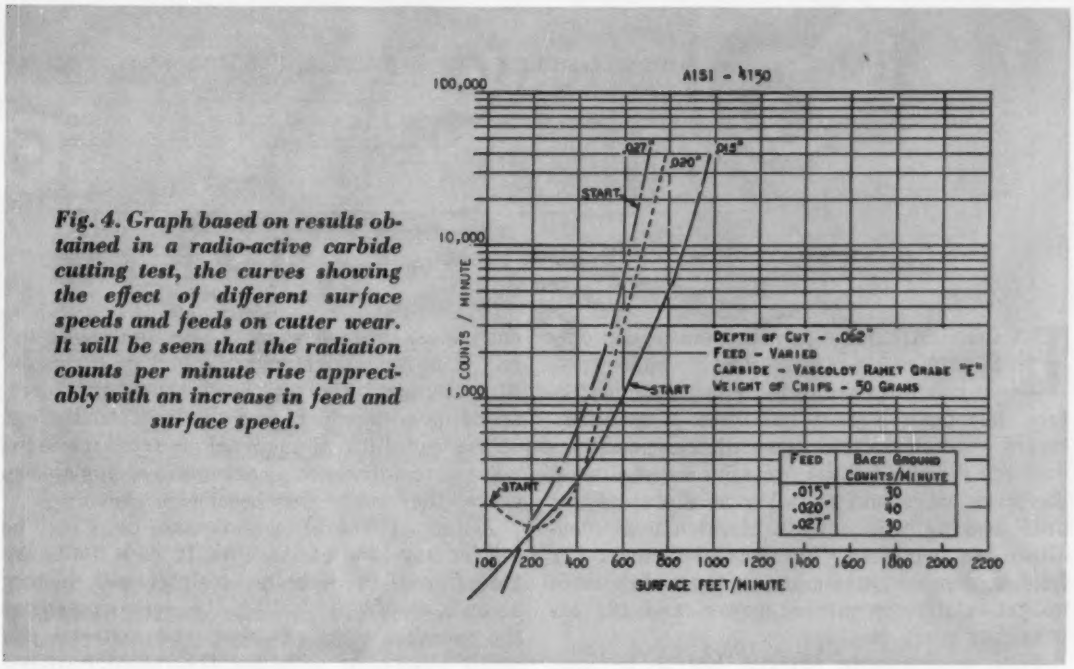


Fig. 4. Graph based on results obtained in a radio-active carbide cutting test, the curves showing the effect of different surface speeds and feeds on cutter wear. It will be seen that the radiation counts per minute rise appreciably with an increase in feed and surface speed.

grams is used for taking a measurement of their radiation intensity by means of the rate meter. For each set of conditions, the actual cutting time on the machine is from fifteen to twenty-five seconds.

While the radiation intensity of the chips is being determined, the metal chips are contained in a test tube that may be seen protruding above the well counter located to the right of the rate meter in Fig. 2. The amount of radiation occurring in the chip samples is so low that they may be handled as standard chips after having been removed from the turret lathe.

The graph presented in Fig. 4 shows a typical set of curves plotted from a radio-isotope cutting test. These curves indicate the cutter wear obtained with different feeds and speeds but with the depth of cut the same in each case. The material machined was AISI 4150 steel. In a similar manner graphs may be drawn based on the results obtained with a large variety of materials and machines, and many combinations of speed, feed, and depth of cut. "Counts per minute" indicates the radiation intensity measured with the rate meter in the determination of tool wear occurring during metal removal.

Actual findings so far have indicated a trend rather than given much specific information. One material can be compared with another under a given set of machining conditions but, as yet, with a single curve on just one material, it is not possible to state that the material can be machined at a certain rate. Also, it has not as yet been feasible to determine from the amount of radiation occurring in the chip samples exactly how much wear has taken place on the cutting tip in thousandths of an inch. It is anticipated that later tests will provide this information and that tool life can be calculated after taking one cut with a radio-active tool.

Experiments in which isotopes were used to check and verify the life of cutters tested as long ago as 1947 with standard mechanical equipment have indicated that isotopes permit up to a two-third reduction in the time required to complete a given test study. Also, the extremely minute measurements possible by means of isotopes have revealed many peculiar aspects of previous tool-life curves that could not be otherwise detected. Based on the limited results to date, it is believed that, eventually, accurate evaluation of carbide tools and tool geometry may be possible under any set of machining conditions. This is the direction of current research.

A New Approach to Machine Replacement

By B. A. Margo

ECONOMICAL shop management can only be attained if excessive maintenance costs on machines are immediately detected before they become gross liabilities. If manufacturers were aware that many of their machines over ten years old cause excessive expenditures, the machines would probably be discarded for profit-making replacements. Maintenance expenditure has two closely interrelated factors: (1) total expense as represented by the maintenance budget relative to earning power, and (2) expense for every machine.

Total maintenance expense has to be kept within predetermined limits to maintain net earnings at a certain level. This logically requires that the upkeep for each machine be held within certain limits. A system of keeping track of costs for individual machines in relation to the total budget, which will also indicate when machines should be replaced, is described in this article. This system is of particular interest to machine tool builders and users who have maintenance problems. In the case of machine tool manufacturers, a twofold benefit may be realized: first, the method may be used in their own plants, and second, as an aid to representatives in selling their machines.

As used here, the maintenance budget, hereafter to be called budget, allows a definite amount of expenditure per machine on the average. Less is spent for maintaining new machines than for old ones. However, a limit must be set for maintaining the old machines, otherwise the expense becomes unbalanced. The average allowance for each machine could not then be sustained.

As seen in Table 1, the life of a machine may be correlated to its maintenance expenditure. "Machine condition" (top line) shows the different phases through which a machine passes unless it is replaced before the end of its useful life. "Budget" (bottom line) shows the corresponding costs which reach a "limit" at the end of the useful life of the machine from the viewpoint of maintenance. If expenditures for upkeep exceed the "limit," they become excessive.

A limit of monthly maintenance costs may be set for any kind of machine. If such limits are transferred to machine maintenance history records, shown in Table 2, the clerk who enters the monthly costs of labor and material can easily observe if costs for the machine exceed the limit. This is an automatic and inexpensive routine for the detection of immoderate expense, and makes such cards an essential tool of management. In Table 2 reference number 1960 has a prorated expense of $50 on a repair costing $600 which is good for twelve months.

Limits may also be put in tables prepared by machine tool manufacturers. These tables would be given to users of machines so they would be able to observe for themselves when maintenance costs become excessive. Such tables could also be used by sales engineers to enable them to point out to users specific machines with prohibitive maintenance expenses.

One of the factors to be considered when determining limits has to be the average maintenance dollar. For example, if the budget is $30,000 per year, or $2500 per month, and the investment for machines is $500,000, there is

$$\frac{\$2500}{\$500{,}000} = \$0.005$$ available per dollar invested.

That is, $0.005 per month is the average amount of money for maintaining a machine costing $1 and working under average conditions. If this

Table 1. Machine Life Correlated to Maintenance Expenditure

Machine Condition	New	Up to Average	Average	Over Average	End of Useful Life	Should Have Been Replaced
Budget	Small	Up to Average	Average	Over Average	Limit	Excessive

Table 2. Machine Maintenance History Card

Month, 1955-56	Reference No.	Labor Costs, Dollars	Material Costs, Dollars	Subtotal in Dollars	Overhead, Per Cent	Total Costs, Dollars	Remarks
Oct.	1056	10	125	135	60	216	
Nov.	1810	14	57	71	60	114	
Dec.	1956	15	30	45	60	72	
Dec.	1960			50	60		
Jan.	2409	110	30	140	50	210	
Feb.							
March							
Universal Milling Machine Dept. 567					Limit	$300	Equip. No. 985

amount is varied according to the value of the individual machine, and if a way can be found to express operating conditions by means of one number, limits can be set.

The value of the machine should be the original price adjusted to the purchasing power of the dollar of today, not the replacement value. The sole concern is maintaining a certain investment in this connection, and to be consistent, the variations in the purchasing power of the dollar must be considered. On the other hand, replacing many old machines with identical machines is impossible, so replacement values would be misleading.

Operating conditions may be determined by using wear points such as those given in Table 3. A "wear point" may be defined as a number used for measuring the effect of a specific operating condition upon the wear of a machine or other piece of equipment. If the points selected for a particular machine are multiplied together, a so-called wear factor is found. The average factor for all machines is a measure of the average operating condition. The factors of individual machines divided by the average factor is called wear ratio, a figure which indicates whether a machine is subject to more or less than average wear.

Finally, a decision must be made for the increase of maintenance costs to be tolerated when a machine reaches the limit. That is, it may be indicated that the limit shall be reached when actual costs become double the sum of the $0.005 set for every dollar value of the machine, or $0.01. A higher or lower ratio may be set. This factor may be varied, if necessary, to accelerate or decelerate replacement of machines in a systematic and impartial manner.

In calculating limits, a table is made similar to Table 4. For machine No. 1, it is found that:

$$\$17{,}500 \times \$0.01 \times 0.12 = \$21 \text{ per month}$$

The value of the machine is $17,500; $0.01 is double the budget set for dollar value of every machine, and 0.12 is the wear ratio found by dividing the wear factor 4 by the average wear factor 33.6.

For machine No. 10 the following wear points were selected from Table 3: Usage of the machine on only one shift (Item No. 1 in Table 3) results in a wear point of 1.2; continuous fluctuation of the load (Item 2) gives a 2.4 degree of wear; slight vibration (Item 3) is 2.0; stress (Item 4) is high with a wear point of 1.6, and since the machine is of critical importance (Item 15), the wear point for this factor is 1.4. By multiplying

$$1.2 \times 2.4 \times 2.0 \times 1.6 \times 1.4 = 12.9$$

the wear factor is determined at approximately 13. Accordingly, the limit may be calculated thus:

$$\$22{,}000 \times \$0.01 \times 0.39 = \$86 \text{ per month}$$

The figure 0.39 is the wear ratio, found by dividing the wear factor 13 by the average wear factor 33.6.

These calculations show how extremely simple the setting of limits becomes as soon as the table of wear points has been established. Compared to the permanent benefits obtained from using this method of machine replacement, the establishment of a table of wear points is a relatively small effort.

The total of monthly limits of $6213 shown in Table 4 is higher than double the monthly budget ($2500), amounting to $5000. This may seem to be a discrepancy since the limit total

Table 3. Table of Wear Points

Item No.	Operating Conditions: Description		Wear Points
1	Usage	1 Shift	1.2
		2 Shifts	2.6
		3 Shifts	4.0
2	Load	Constant	1.2
		Slight fluctuation	1.7
		Continuous fluctuation	2.4
		Repeated shock	3.6
3	Vibration	None	1.0
		Slight	2.0
		Medium	3.0
		Severe	4.0
4	Stress	Small	1.1
		Medium	1.3
		High	1.6
5	Capacity, gallons per minute	1000	1.2
		5000	1.4
		10,000	1.6
6	Cavitation	None	1.0
		Slight	1.3
		Medium	1.7
		Severe	2.2
7	Corrosion	None	1.0
		Slight	2.0
		Medium	4.0
		Severe	8.0
8	Abrasive content, abrasion	None	1.0
		Small	1.2
9	Temperature fluctuation	Negligible	1.0
		Gradual	1.3
		Sudden	2.5
10	Velocity	Small	1.1
		Medium	1.2
		High	1.3
11	Erosion	None	1.0
		Small	1.1
		Medium	1.5
		High	2.0
12	Use outdoors	Summer	1.2
		Winter	1.4
13	Treatment by operators	Good	1.0
		Bad	1.5
14	Unsuitable material used in unit		2.0
15	Unit importance	Non-critical	1.0
		Semi-critical	1.2
		Critical	1.4

and the monthly budget would be expected to be identical according to the decision that the limit should be double the average maintenance cost.

Actually, the total limit arrived at in the calculations might be higher or lower than double the monthly budget. As a matter of fact, it would be a coincidence if identity was obtained. However, any discrepancy of this kind has no practical importance. The definition of the two categories is different: limits indicate when to stop spending while the budget implicitly states what to spend. To imply that all limits may be reached simultaneously is not a practical possibility.

Wear points may be established by using the judgment of good maintenance men, information contained in literature, laboratory tests, reliable maintenance records or a combination of these means. It is advisable to define such expressions as "small," "medium," "high," and "negligible," "gradual," "sudden" used in Table 3 by means of concrete data wherever feasible and to collect such data in a manual. Eventually, tables may be made available to various industries showing wear of a great variety of materials under the influence of different degrees of vibration, corrosion, load, and other operating factors. Such tables will be a help to the plant engineer who wants to write up a table of wear points.

The reliability of the points may be checked by means of a graph similar to the specimen shown in the accompanying illustration. This graph is based on the observation that there normally exists a relation between operating conditions, as expressed by the factors, and the intervals between overhauls. A machine with a factor of 60 may require an overhaul every six months. Consequently, a machine subject to half the wear, with a factor of 30, should require an overhaul only once a year.

It is advisable that this graph be made as soon as possible at the beginning of the process of setting wear points. To do this, the machine subject to the greatest wear is selected. Since the intervals between overhauls of this machine should be known, the point farthest to the right of the curve may be determined by using a tentative factor. The factors and intervals between overhauls of all other machines should fit into this graph to close limits.

As soon as the reliability of the graph has been established, it may also be used to set the intervals of inspections for all existing machines. In addition, it should prove to be particularly valuable whenever a machine of a kind never before used has to be installed. Then the graph may be used to set intervals of inspections and overhauls immediately, which should be instrumental in operating such a machine with small risk of

damage as well as a minimum of expense for maintenance. Eventually, a standard graph may be used by the manufacturer to tell the customer at what intervals the new machine should be inspected and overhauled. In this connection the expressions "inspection" and "overhaul" would require clear definitions as to the details and quality of work to be done.

The task of calculating wear factors is made immeasurably easier in the machine tool industry since many machines, such as engine lathes, turret lathes, automatic lathes and others, are run under similar operating conditions. In all such cases, the wear factor is calculated for the type of machine only, not for the individual machine.

If a machine which has permanently passed the limit is termed obsolete from the viewpoint of upkeep, valuable control figures are obtained to measure obsolescence and its effects upon the replacement program as well as upon the budget. First, the maintenance history cards of all obsolete machines would be earmarked at regular intervals. Second, a superficial picture of the situation may be obtained by counting the total number of obsolete machines. Also, the totals of the various types of machines, as well as the total number of machines in each department, would be calculated. These figures in relation to the number of machines which are not obsolete give some measure of obsolescence. Next, a cost comparison is prepared of the total number and cost of obsolete and useful machines, as shown in Table 5. This may also be done for each type of machine and for each department.

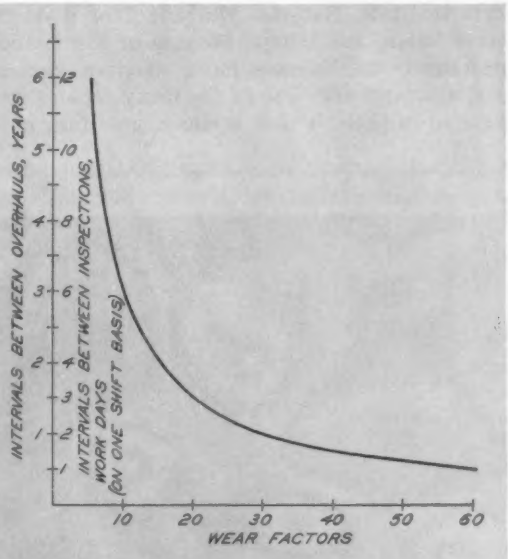
The extra cost necessary to carry the obsolete units would amount to 276 × $53 = $14,600 per month, or 17.5 per cent of the total monthly expense of $83,333. The sum $53 is the difference between $135 and $82. If comparisons of these data at regular intervals indicate a trend to one extremity or the other, the necessity for substantiating the need for more replacements, or adjustments in the budget, will be made more evident.

The limits marked on history cards will function as an insurance that excessive maintenance costs will come to light immediately. The new set-up should also be instrumental in preventing excessive costs. If a machine requires a large repair, the plant engineer would be well advised to check the maintenance history card to find out if this repair would bring the machine over the limit. If so, and providing that spare capacity is available, he may bring the situation immediately to the attention of the proper authority in charge of replacements. Thus, it might frequently be possible to avoid such large repairs which, from an over-all viewpoint, would be a waste of money.

But it stands to reason that a large repair might bring any machine over the limit if the total maintenance cost were placed in the monthly record at the time the expense occurred. This should be avoided according to normal cost accounting practice. Costs of large repair jobs should be spread over a period of months according to their expected effect. If this procedure

Table 4. Monthly Limit of Maintenance Expense per Machine

Machine No.	Value	Wear Factor	Wear Ratio	Monthly Limit
1	$ 17,500	4	0.12	$ 21
2	23,500	25	0.74	174
3	45,000	17	0.51	230
4	96,000	49	1.46	1400
5	105,000	65	1.93	2025
6	67,500	28	0.83	560
7	48,000	36	1.07	513
8	65,000	55	1.64	1066
9	10,500	44	1.31	138
10	22,000	13	0.39	86
Totals	$500,000	336		$6213
Average Wear Factor 33.6				



Graph employed to verify the reliability of wear factors by checking them against intervals of overhauls

Table 5. Comparison of Maintenance Costs and Condition of Machines

Number of Machines	Per Cent of Total	Condition of Machines	Monthly Maintenance Costs	Per Cent of Total	Average Cost per Machine
276	33	Obsolete	$37,300	45	$135
559	67	Good	46,033	55	82
835	100	Mixed	$83,333	100	$100

is followed, the sum of the total maintenance costs per month per department may be taken from the history cards, thus avoiding duplication on the part of the cost accountant.

Only a few hours would be necessary to change even thousands of limits. And this should occur at rare occasions only, as:

1. whenever operating conditions change substantially and permanently;
2. if the budget should be changed substantially and permanently, independent of a change in the purchasing power of the dollar.

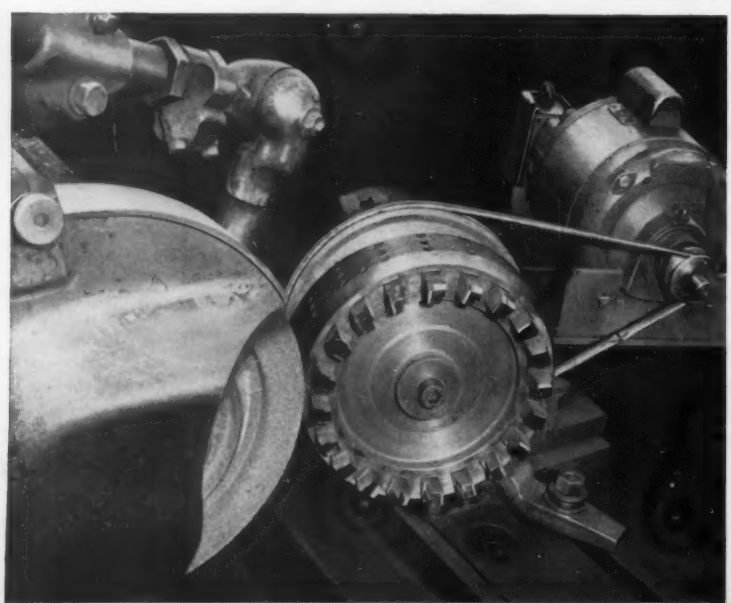
If the purchasing power of the dollar changes, it should not normally be necessary to adjust the values of units or the limits since a constant $0.01 is being used, which is the doubled ratio between budget and investment, $\frac{\$2500}{\$500,000}$. This may be expected to remain about the same.

Formulas of the Machinery and Allied Products Institute, National Machine Tool Builders' Association, and others, because of the method described, may become more effective tools of management since one of the many factors considered in them is now a measurable factor. In addition, it may be expected that this new approach to machine replacement will lead to an earlier and more extensive use of such formulas.

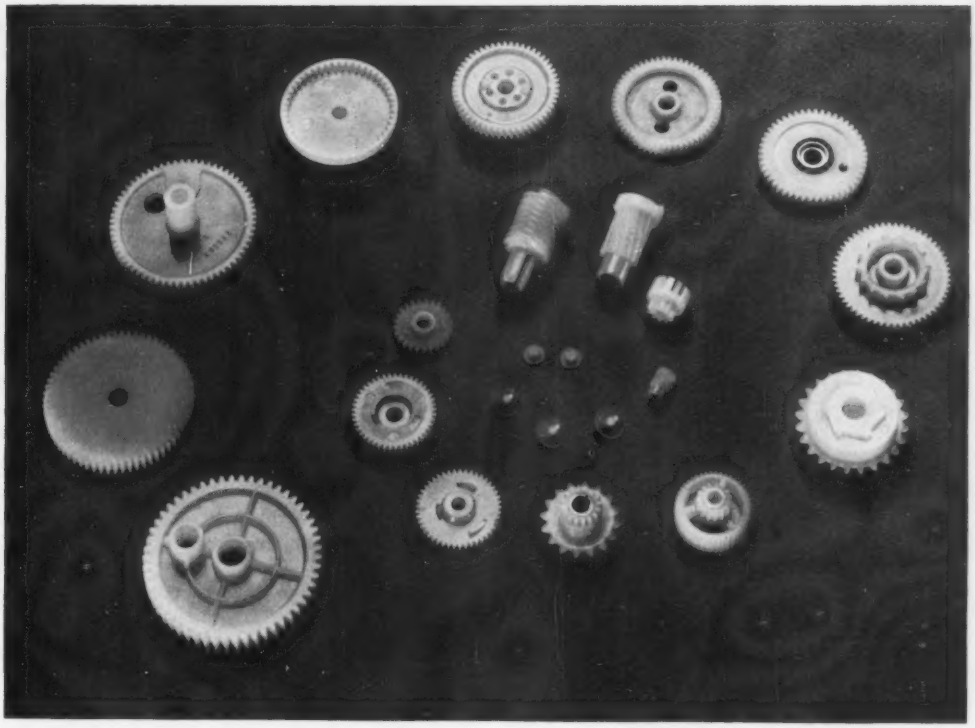
A summary of the benefits inherent to this new approach of calculating wear factors and maintenance costs with a maintenance budget follows:

1. Money is saved by avoiding unadvised repairs;
2. Capital investments are utilized to better advantage by keeping certain machines in operation for a longer time, thus avoiding disagreeable hidden losses;
3. A balanced machine replacement program is developed;
4. Budgets may be adjusted sooner, using measurable factors;
5. An additional measure for the efficiency of departments is obtained;
6. Schedules of inspections and repairs may be determined for machines of a kind never before used.

For machine tool manufacturers, the new method might prove a powerful wedge for breaking down the sales resistance of many users of obsolete machines.



Twenty single-point cutters are ground at one time with this new tool-holder designed at the Glenn L. Martin Co., Baltimore, Md. The cutters are secured in slots by set-screws, and the holder is rotated in a direction opposite to the silicon-carbide grinding wheel. Cutters are ground five times faster than with the single grinding method.



The ABC's of Designing Injection-Molded Nylon Gears

By L. D. MARTIN, Gear Consultant
Rochester, N. Y.

PREPARING specifications for injection-molded nylon gears requires a thorough knowledge of all phases of manufacture. Tooth geometry and shape, of course, must be considered. Other factors that have to be taken into account include: material shrinkage, moisture absorption, ambient operating temperature, and part configuration. As a case in point, for a bar of Zytel 101, 1/8 inch thick, 1/2 inch wide, and 5 inches long, width will change, due to moisture absorption, about three times as much as length. The reason for this is that the moisture is concentrated as a thin layer on the surface of the bar. Coping with other factors that affect gear dimensions requires an expert knowledge of the molding art and a large fund of empirical data.

A designer who specifies the same tolerances for injection-molded nylon gears as for cut metal gears is either unaware of all manufacturing variables and material characteristics, or is a confirmed optimist. The same thing applies to a buyer who sends out a drawing for a quotation with insufficient information. In Fig. 1 a representative case is shown of a drawing sent out to injection-molding companies for a quotation. Examination of the drawing discloses first, that a 14 1/2-degree involute form is specified, but the enlarged view defining the tooth outline by circular arcs contradicts this. An involute form should not be defined by a single circular arc, especially when the center of the arc is not located.

Secondly, the note "special tooth form above pitch line" is ambiguous and meaningless when the form is not fully dimensioned, as is the case here. Thirdly, no tolerances of any kind are given. While a tooth thickness of 0.098 inch at

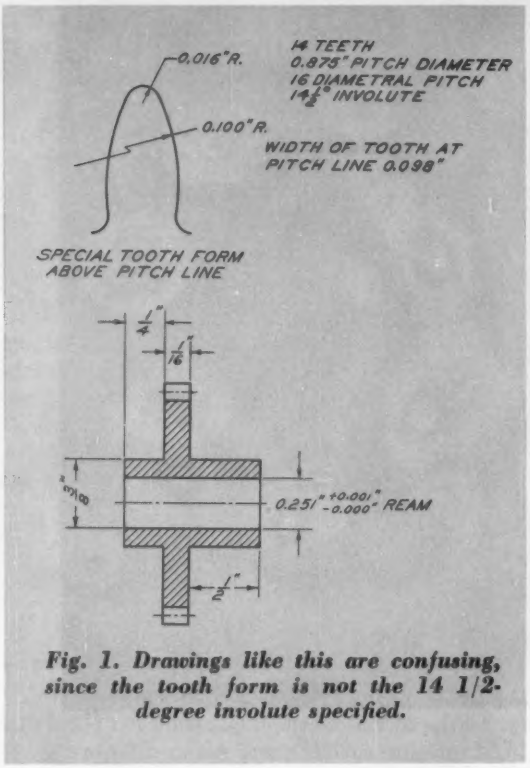


Fig. 1. Drawings like this are confusing, since the tooth form is not the 14 1/2-degree involute specified.

the pitch line is given, this dimension is a nominal one, and has no tolerance. To add to the confusion, no stipulation of concentricity is made. Furthermore, a bore tolerance of plus 0.001 inch, minus 0.000 inch is given for a reaming operation, when actually no such operation is involved in molding.

Here is what frequently happens. A gear is being made of metal to some special form that has been found to give satisfactory service. The suggestion is made that the part be injection-molded of nylon at a considerable saving. A drawing of the metal part is sent to a molding company for quotation. The buyer, not being conversant with gearing terminology, assumes that the information on the drawing is complete. If the molder lacks experience in gear design, as a great many do, he might bid on the job and land it, not realizing the pitfalls connected with it. As a result, the customer gets a molded gear that often cannot possibly replace the metal gear.

Another example of the lack of realism and appreciation of molding problems involves the gear shown in Fig. 2. As a precision metal part, the gear is well-dimensioned. Tolerances of a composite check with a 1.500-inch diameter master gear are given, and these can only be met by the use of very accurate generating processes. Also given is a bore tolerance of plus 0.0005 inch, minus 0.0005 inch, which is entirely too close for injection-molding. What is more, the general configuration of the gear, while perhaps entirely satisfactory as a metal part, has a number of limitations as a molded part. Wall sections are too thin, and the difference between the bore and the hub diameter is too small. In being molded, the wall through the hub will cool more rapidly than the wall through the gear face. The difference in cooling rate will usually result in a tapered bore, unless this change is anticipated and due allowances made in the mold.

At any rate, a realistic bore tolerance for this gear as molded would be plus 0.0015 inch, minus 0.0015 inch. The composite error and size allowance, which are combined to give the total radial displacement, should be approximately 0.003 to 0.005 inch for nylon gears, in contrast to the 0.001-inch allowance for a cut metal gear, as specified on the drawing as a change in center distance. Since a mold contains generally from four to sixteen cavities for a gear of this size, all of the cavities and parts molded from them cannot be exactly alike. A much broader tolerance suitable to the process is indicated.

Compared to die-castings or sand castings, injection-molded parts are certainly in a precision class. On the other hand, they cannot be

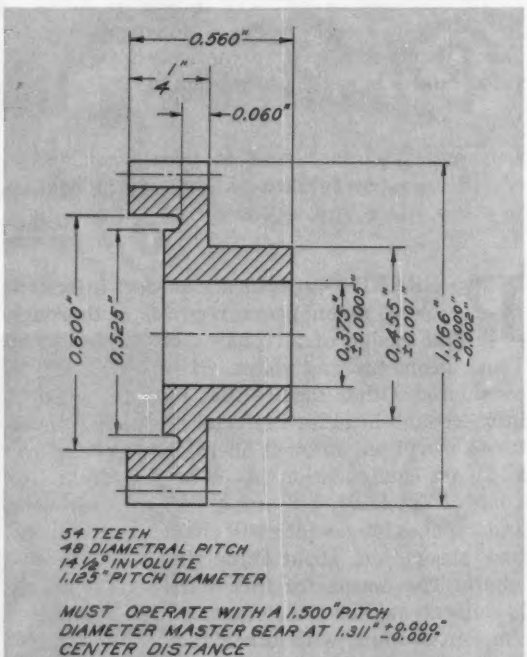


Fig. 2. Drawings like this that are intended for cut metal gears are totally inadequate for injection-molded nylon gears.

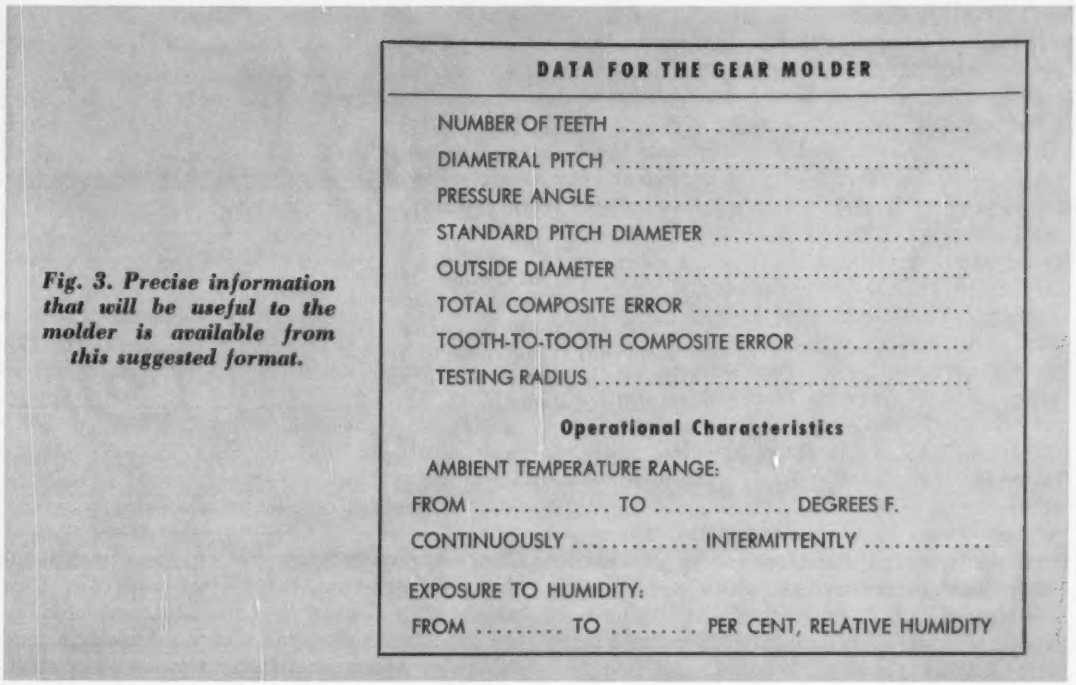


Fig. 3. Precise information that will be useful to the molder is available from this suggested format.

expected to measure up to the accuracy obtainable in a cut metal gear. This is particularly true of nylon and some other thermoplastic materials which are affected by moisture and temperature changes.

The yardstick of quality for fine-pitch gears has been established by the American Standard B6.11-1951. This standard uses the composite, or functional, check as a basis of grading quality. According to the standard, the great majority of injection-molded nylon gears will not fall within the quality specifications of precision gears. This does not mean that nylon gears are inferior and will not work satisfactorily, but simply that some other criterion must be used. Actually, there are thousands of successful applications of injection-molded nylon gears.

Because of their inherent resiliency, nylon gears generally do not have to meet the precision of cut metal gears. This ability to yield under pressure is a very desirable property in gearing, since it tends to smooth out pitch and profile errors through the arc of engagement. Nylon also has a low coefficient of friction, which enhances its value as a gear material. If not stressed beyond its safe working limit, approximately 4500 pounds per square inch, nylon gears will outperform cut metal gears. There are cases on record where nylon gears have exhibited three times the life of cut metal gears.

In Fig. 3 is a format recommended for the drawing information on an injection-molded nylon gear. Besides the required dimensional data, it contains functional data that will permit the molder to suggest desirable design changes when necessary.

A mold shrinkage allowance of 0.012 to 0.022 inch per inch of diameter must be made on tools for producing the cavity. Some such tools might be a punch, an electrode, or an expendable brass master used in electro-forming. These must be made larger than the size of the gear, the allowance being greater when the gears are normalized following molding. If a standard generating cutter is used, the form will be incorrect when the part shrinks. In that case, the hob or cutter must have a pitch correction for shrinkage.

As an example, a 48-pitch gear of 20-degree pressure angle is desired, having 48 teeth and a 1-inch pitch diameter. Shrinkage allowance has been computed to be 0.015 inch per inch of cavity diameter. The cavity, to be made in beryllium copper, will have to be 0.015 inch larger than the finished part. This means that the cavity punch will necessarily be coarser than 48 pitch. The actual pitch of the punch is found by the following equation:

$$\frac{48}{1.015} = 47.290 \text{ diametral pitch}$$

If a standard 48-pitch hob or generating cutter were used to produce the punch, the profile curve of the finished part would also be incorrect. The approximate change in pressure angle resulting

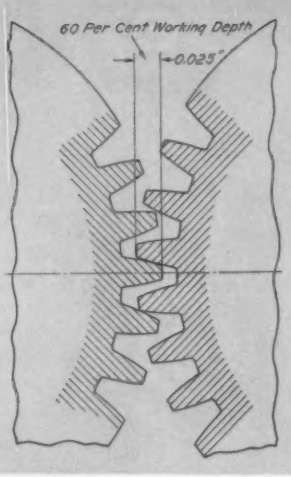
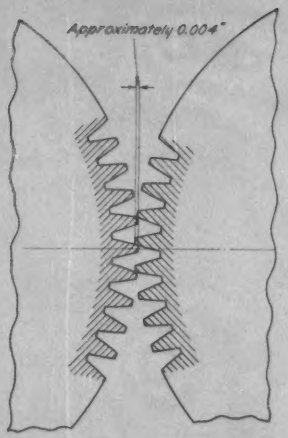


Fig. 4. (Left) The pitch of this gear set permits sufficient tooth engagement at reduced temperatures.

Fig. 5. (Right) When the pitch is fine and diameter large, the depth of engagement might be reduced to an impractical limit, as shown.



from the use of a standard hob or generating cutter can be determined as follows:

$$\text{Cos } \phi_1 = \frac{D \cos \phi}{D_1} = 0.9258029 = 22^\circ\ 12'$$

where

ϕ_1 = pressure angle on enlarged diameter;
ϕ = standard pressure angle;
D_1 = enlarged pitch diameter;
D = standard pitch diameter.

A difference in pressure angle of 2 degrees 12 minutes is usually more than can be tolerated. The approximate profile error resulting from this change in pressure angle is found by multiplying the working depth by tan 2 degrees 12 minutes, thus:

0.04167 tan 2 degrees 12 minutes = 0.0016

This amount is entirely too much even for a material like nylon, with its inherent flexure, or compliability.

A practical solution is to assume that two mating gears having the same general configuration will therefore have the same shrinkage factor. It is both possible and practical to produce the punch with a standard 48-pitch, 20-degree pressure angle hob. The resulting gears would both have a larger pressure angle, but this would be of no consequence. They would be conjugates of each other and operate perfectly satisfactorily. All that would be required is a drawing change. This procedure is followed sometimes, with the result that tool cost is lower and delivery much quicker.

Specifications for nylon gears should also anticipate possible swelling either from change in the ambient temperature or from moisture absorption. Although normalizing will assist substantially in stabilizing the part against the effects of moisture absorption, the dimensional changes from temperature increases cannot be stabilized, and must be carefully considered by the designer. Nylon has a thermal coefficient of expansion approximately ten times that of steel. If mating nylon gears are mounted on a steel plate and the ambient temperature range reaches 100 degrees or more above room temperature, allowances will have to be made for the enlargement of the parts. Suitable clearance must be provided in the gear teeth so that they can operate at the lowest point in the temperature range with satisfactory contact and yet not bind when expanded at the highest point in the range.

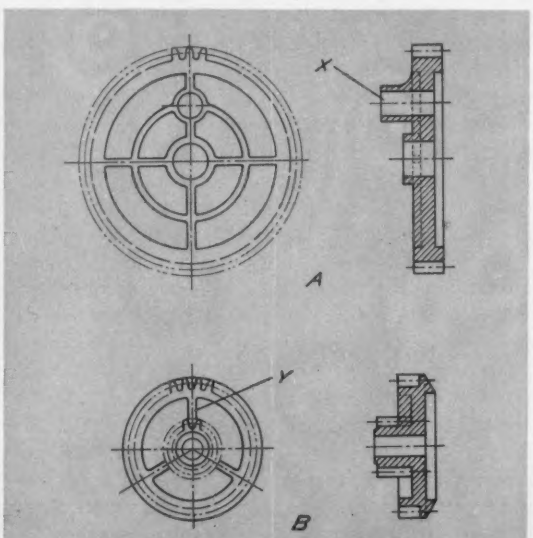


Fig. 6. Localized dimensional changes are created by hole (X) in the gear in view A and ribs (Y) in the gear view B.

The practical limitation on the amount of this clearance is illustrated in Figs. 4 and 5. Supposing that satisfactory tooth contact to carry a given load and meet other functional requirements calls for at least 60 per cent of the tooth depth in engagement, as in Fig. 4, it is then apparent that the size of the gear will govern the retainment of a satisfactory depth of engagement. If the gear has a large diameter, and the pitch is fine, a point will be reached where there will be no tooth engagement at all, as in Fig. 5. This will happen when the gears reduce their diameter ten times as much as the shrinkage of the steel mounting plate at a temperature drop of around 90 degrees.

For example, two 48-pitch gears having a 1.500-inch pitch diameter and 72 teeth are mounted on a steel plate. The ambient temperature ranges from —20 to 150 degrees F. The thermal coefficient differential between nylon and steel is approximately 0.00005 inch per inch per degree F. At 80 degrees above room temperature, or 150 degrees F., the gears will increase 0.006 inch ($80 \times 1.500 \times 0.00005 = 0.006$) in size. Therefore, the bearing holes in the steel plate will have to be at a center distance of 1.506 inches at room temperature, instead of the nominal 1.500 inches.

If to this allowance is added a realistic tolerance for total composite error and backlash, it is easy to see that this set of 48-pitch gears, when at room temperature, will have to have a testing radius about 0.006 inch smaller than the standard pitch radius. If two such gears are mounted together, their depth of engagement will be 0.012 inch smaller than the working depth of 0.0417 inch for this pitch, or approximately 0.030 inch. This amounts to a loss of tooth engagement of about 29 per cent.

At —20 degrees F. the same gear set has a depth of engagement of only 0.023 inch ($0.030 - [0.00005 \times 1.500 \times 90] = 0.023$). This is just about 55 per cent of full tooth depth, and hardly enough to meet functional requirements. If such a gear instead of engaging another of the same size were to mesh with a small pinion having a small profile contact ratio, a 47 per cent loss of tooth engagement would cause complete loss of continuous action.

A 48-pitch combination has been considered. If the pitch were finer, such as 80-pitch, tooth engagement would be about 0.004 inch at —20 degrees F. for a pair of gears of equal size. Thus, it will be seen that a point is reached where the pitch becomes too fine for the size of the gear. To avoid this condition, the gears can be designed with metal inserts, which will reduce the wall thickness of the nylon and, consequently, its shrinkage rate. Such practice is quite common. When properly designed, the gears are perfectly safe to use, and offer a good compromise between cost and design objectives. Gears molded on inserts possess a high degree of stability because of the smaller amount of material used, and can usually be made with much greater accuracy than those without inserts.

The geometry of injection-molded gears is not by itself an important factor. Any tooth form that can be produced by machining methods can also be molded. As a matter of fact, sometimes intricate shapes that would pose machining problems can be more readily molded than cut. Wherever possible, however, 20-degree involute full depth teeth should be used. The American Standard 20-degree Involute Fine-Pitch System for Spur and Helical Gears, A.S.A. B6.7-1950, has withstood the acid test of many years of usage, and is still a good toothform system to follow for the vast majority of gears used in consumer goods. For quality control, the best yardstick available is the American Standard Inspection of Fine-Pitch Gears, A.S.A. B6.11-1051. This standard has been widely publicized and used, and has created order in a greatly diversified field where utter chaos existed only a few years ago.

Unfortunately, many injection-molded gears today still show poor design. In view A of Fig. 6, for example, is a helical gear which would have

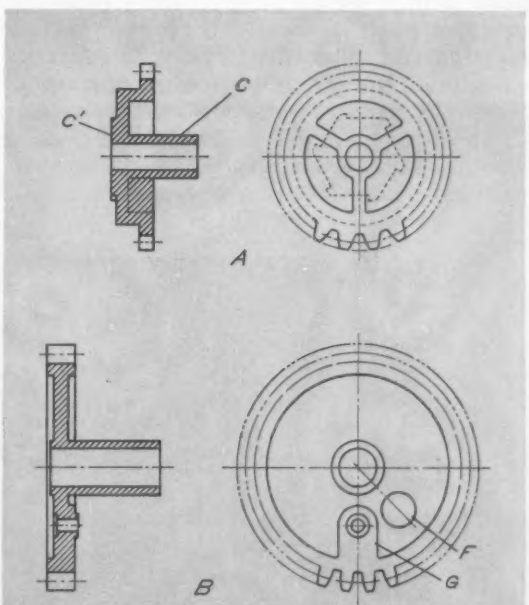


Fig. 7. The hub (C) of the gear in view A is too long, and its wall is too thin. Hole (F) and pad (G) in the gear in view B have an adverse effect on the cooling rate.

been well constructed if it were not for the hole through the hub at *X*. This hole prevents the teeth in that area from shrinking as much as the others, thus producing an out-of-round condition. The rib above the hole is not large enough to materially alter this uneven shrinkage. An improved construction would have been provided by incorporating a metal insert. The gear cluster, view B, has three ribs *Y*. Although the ribs serve to reduce weight and thus save material, they cause localized dimension changes that appear as pitch errors in the teeth. A better design to reduce weight is to substitute a series of circular grooves for the ribs.

Another example of a ribbed part having localized changes appears in view A, Fig. 7. Here, the bore is too long, and the hub wall too thin. An accurate bore will be difficult to obtain, since the hub will cool more quickly at *C* than at *C'*. In view B is another instance of troublesome hub and bore proportions. Hole *F* and pad *G* are sources of errors in gear teeth because of a different rate of cooling in this area.

Close teamwork between the molder and the engineering staff pays big dividends. It helps in ironing out difficulties in the early stages of design. The molder can often make helpful suggestions that result in a better and cheaper product. Gears are complex, mechanical components. It is hard enough to control accuracy in cut metal gears with first-class tooling, where parts are produced singly. Obviously, it becomes increasingly difficult in molding, with its many variables, to control quality when often as many as thirty-two parts are produced simultaneously. The industrious engineer will make sure that his drawings are clear and spell out exactly what he must have. Likewise, the alert buyer will take a good look at the drawings he sends out for quotation. He must make sure that the prospective molder has all the necessary information.

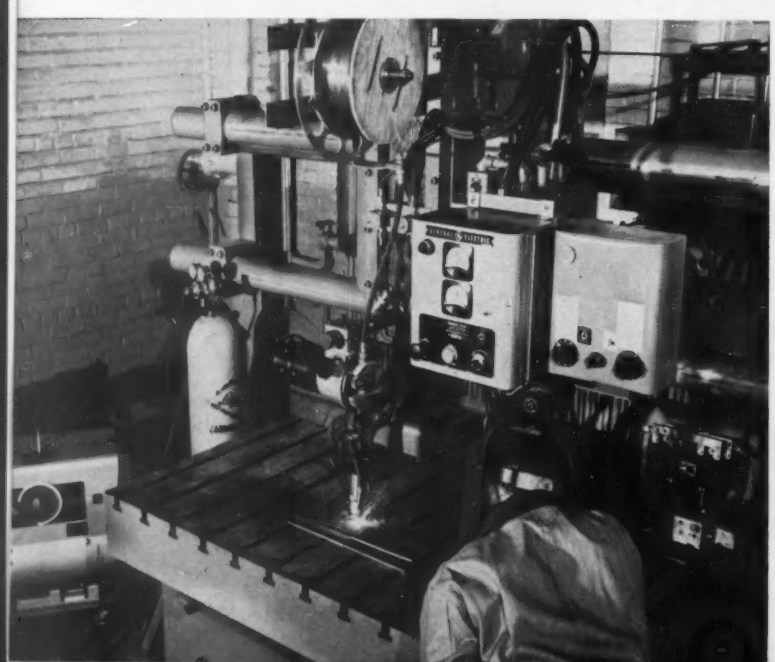
An article dealing with considerations involved in checking nylon gears will be published in December MACHINERY.

* * *

Automatic Welding Equipment Shields Arc with Carbon Dioxide

Automatic consumable-electrode welding equipment, especially adapted for use with low-cost carbon-dioxide shielding gas, has been announced by General Electric Co.'s Welding Department at York, Pa. The equipment provides a practical method of using gas-shielded welding for mild-steel applications. Two recent advances have led to the development of this welding system; an understanding of the need for a shorter arc and a higher rate of wire feed in gas-shielded welding, and the recent availability of a dry, welding grade of carbon dioxide.

An arc of constant length, that is unaffected by changes in the rate of wire feed, is provided automatically by a self-regulating "Fillerarc" generator. The generator has a rising volt-ampere characteristic that matches the rising volt-ampere characteristic of the arc within an inert-gas shield. The rate at which the electrode burns off always matches the rate of wire feed, thus maintaining a constant arc length. This consumable-electrode welding equipment provides high wire-feed rates, up to 1000 inches per minute, and short arc lengths to produce a deeply penetrating arc with a minimum of spatter. A single generator dial permits arc length selection.



Automatic gas-shielded arc-welding equipment utilizes carbon dioxide as an enveloping medium

Choosing Flexible Shafts for Specific Applications

By C. Hotchkiss, Jr., Flexible Shaft Engineer
Stow Mfg. Co., Binghamton, N. Y.

FLEXIBLE shafting is being used extensively in industry on all types of machinery. The purpose of a flexible shaft is to transmit rotary power or motion over a curved path. Motion is transmitted by a flexible core made up of layers of wire, which are covered by a metal- or rubber-covered casing. The casing not only supports the core, but also acts as the bearing surface for the core. A wide variety of standard shafts are available for different applications. For fixed installations, where both ends will be held in place as seen in Fig. 1, shafts with built-in ball or sleeve bearings are available. Where the flexible shaft is to be used with accessories as a lightweight portable tool, standard flexible shafts can be obtained with hand pieces or right-angle heads of different speed ratios.

All flexible shaft applications can be divided into two major types: power drives, where power is transmitted; and remote controls, where only the torque transmitted is considered. A typical standard flexible shaft with couplings on both ends is illustrated in Fig. 2. Such shafts can be used for power drive or remote control applications. The layers of wire making up the flexible shaft core are clearly visible. Each successive layer of wire is wound in a direction opposite to that of the preceding one. Low-cost cores are usually made from a combination of low- and high-carbon steel wires on automatic, high-speed winding machines. Medium-cost, tightly wound cores are generally made from music wire, with a high-carbon steel center, on semi-automatic winding machines. Higher cost assembled cores are often made of music wire that can be cut without unraveling. A standard flexible shaft having a motor connection at one end and a hand-piece at the opposite end, is shown in Fig. 3. Such shafts can be used for drilling, grinding, polishing, and similar operations. A right-angle head can be substituted for the hand-piece.

Flexible shafting as a power drive is used for

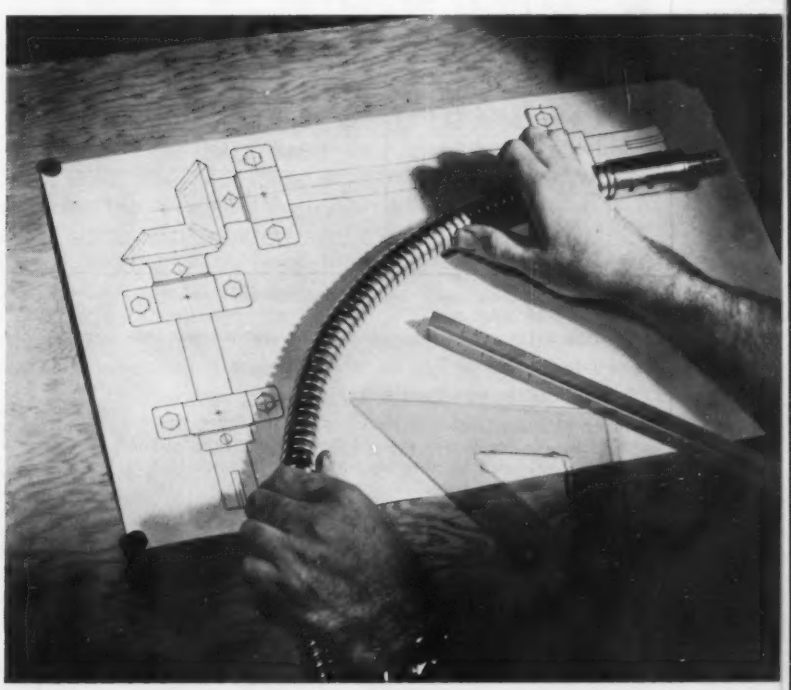


Fig. 1. Typical application of flexible shafts is to connect shafts having relative motion. For fixed installations, shafts with bearings are available

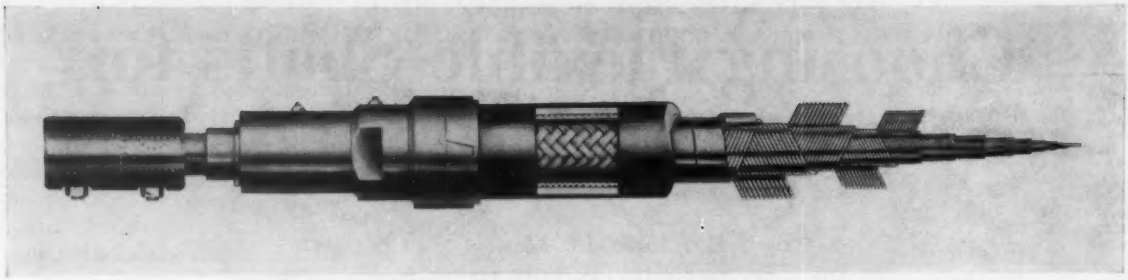


Table 1. Dynamic Torque Capacity of Flexible Shaft Cores for Various Radii of Curvature

Rated Speed, R.P.M.*	MAXIMUM DYNAMIC TORQUE CAPACITY, POUNDS-INCHES											Weight, Pounds per 100 Feet	Core Diameter, Inches	Core No. and Type†
	Radius of Curvature, Inches													
	50 to Straight	25	20	15	12	10	8	6	5	4	3			
4500	2.4	2.2	2.0	2.0	1.92	1.9	1.7	1.5	1.25	1.00	0.50	3.0	0.124 to 0.128	1 MH
3800	7.0	6.4	6.0	5.8	5.4	5.0	4.6	3.6	2.0	1.5		4.5	0.148 to 0.152	2 MH
2900	9.4	8.6	8.0	7.6	7.0	6.6	6.0	4.8	3.4	2.0		7.0	0.185 to 0.189	3 MH
2500	22.0	20.0	18.8	17.6	16.0	15.0	12.6	10.8	9.0			12.5	0.247 to 0.252	4 MH
1800	30.0	28.0	26.4	25.0	23.0	21.0	18.0	14.0				20.0	0.308 to 0.313	5 MH
1800	33.8	31.5	29.7	28.1	25.9	23.6	20.2	15.8				20.0	0.308 to 0.313	6 T
1800	36.0	33.0	31.6	30.0	28.0	26.0	22.0	18.0	11.0			21.0	0.324 to 0.329	7 A
1500	80.0	66.0	63.0	58.0	51.0	46.0	37.0	22.0				28.5	0.368 to 0.374	8 A
1500	60.0	54.0	50.0	46.0	42.0	38.0	30.0	24.0				29.0	0.387 to 0.393	9 MH
1500	90.0	81.0	75.0	69.0	63.0	57.0	45.0	36.0				29.0	0.387 to 0.393	10 T
1150	136.0	110.0	104.0	94.0	80.0	72.0	56.0					50.5	0.497 to 0.503	11 A
1150	148	124	110	92	72	56						53.5	0.505 to 0.511	12 T
900	248	200	176	124	84							78.5	0.610 to 0.618	13 T
900	220	204	192	180	152	130						80.5	0.630 to 0.638	14 A
750	340	224	156	76								117	0.747 to 0.753	15 T
600	760	520	420									205	0.998 to 1.004	16 T
440	1500	720										343	1.298 to 1.304	17 T

* Above the rated speed, torque capacity decreases inversely as speed increases.

† Type MH is a low-cost core made from a combination of high-carbon and low-carbon steel wire on automatic machines; Type T, a tightly wound core made from music wire on semi-automatic machines; and Type A, an assembled core made from music wire that can be cut without unraveling.

Example of How to Use the Table:

The problem is to transmit 1/2 H.P. at 1700 R.P.M. through an unsupported flexible shaft in a 25-inch radius, with an estimated starting torque of 150 per cent that of normal operating torque.

1. Calculated torque = $\frac{HP \times 63{,}000}{RPM} = \frac{0.5 \times 63{,}000}{1700} =$ 18.5 pounds-inches.
2. Correction factor for starting torque = 1.5 × 18.5 = 27.75 pounds-inches.
3. Correction factor for unsupported shaft = 27.75 × 1.6 = 44.4 pounds-inches.
4. Referring to Table 1, read downward in column under 25-inch radius until you find a core having a rating of at least 44.4 pounds-inches. In this case, we find that core No. 9 is rated 54 pounds-inches at 1500 R.P.M. Since the given speed is 1700 R.P.M., multiply 54 by 1500 and divide by 1700 (54 × 1500 ÷ 1700) which equals 47.6 pounds-inches, the rated torque at 1700 R.P.M. Therefore, Core No. 9 is correct.

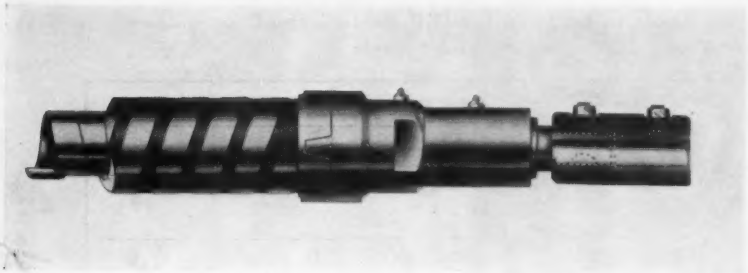


Fig. 2. Standard flexible shaft, having built-in bearings and couplings on both ends, can be used for both power-drive and remote control applications

various applications, such as driving rolls in steel mills; connecting two shafts on a machine tool; and driving brushes, grinding wheels, and other attachments on portable tools. Fig. 4 shows a Commander Multi-Angle drill unit driven by a heavy-duty flexible shaft connected to a vertical, multiple-spindle drilling machine. Such units, having hydraulic actuation of a 4-inch stroke, permit drilling horizontal, angular, and vertical holes simultaneously on a vertical spindle machine. Use of a flexible shaft unit for grinding fins from the inner surfaces of small-diameter cast-iron fittings is illustrated in Fig. 5. Here, a 1/2-inch diameter flexible shaft is transmitting 3/4 H.P. at 3450 R.P.M. to a grinding wheel 2 1/2 inches in diameter.

To help in selecting the correct size flexible shaft to be used, convenient data supplied by manufacturers, as given in Table 1, can be employed. Factors that should be considered in selecting the correct core include the torque to be transmitted, the operating speed, the bends in the shaft, direction of rotation, operating conditions, and length. The torque ratings for flexible shafts are based on continuous operation. However, increased starting or stopping torques, or any suddenly applied torque which exceeds the normal operating torque, may cause permanent distortion of the core. This distortion, which may be in the form of a permanent kink in the shaft, will cause early fatigue and breakdown due to excessive friction within the casing. Therefore, it is the maximum torque that the shaft will have to transmit that should be considered in making the selection. If possible, the maximum load should be determined by actual measurement. Torque can be computed by means of the formula:

$$\text{Torque (in pounds-inches)} = \frac{\text{H.P.} \times 63{,}000}{\text{R.P.M.}}$$

The torque capacities of flexible shaft cores given in Table 1 are based on a surface speed of 300 feet per minute. These figures are the maximum recommended torque, even when running at lower speeds. At higher speeds the torque capacity decreases inversely as the speed increases. The rated speed equivalent to 300 surface feet per minute for each core is shown in the first column. To find the torque capacity of cores operating above rated speeds, multiply the maximum dynamic torque capacity given in the table by the rated speed, and then divide by the operating speed.

It is obvious from the torque formula that for a given horsepower, the higher the operating speed, the lower the applied torque, and, therefore, the smaller the shaft required. Since smaller shafts mean savings in costs, the shaft should be operated at the highest speed which the particular conditions of the application will permit. In some cases, it is even economical to increase the speed at the input end of the shaft and reduce it at the driven element by means of gearing.

Operating Conditions to be Considered

There are two types of bends to be considered in using flexible shafts. The first type is when the shaft remains in a fixed position, so that the bends in the shaft never change. The second type is where there is relative motion between the driving and driven end, which changes the bends. In either case, the bend to be considered in selecting a shaft is the one having the smallest radius of curvature. Since sharp bends greatly influence the torque capacity, as well as the shaft life, the application should be designed with as large a radius of curvature as operating conditions will permit. Each flexible shaft has a minimum radius of curvature, which is the tightest

Fig. 3. On this flexible shaft, a motor connection is provided on the left-hand end and a hand-piece at the right for use as a portable tool. A right-angle head can be substituted for the hand-piece

Table 2. Maximum Size Tools to be Used for Different Sizes of Flexible Shaft Cores, Horsepowers, and Speeds

Core Diameter, Inch	Maximum Horsepower		Maximum Size Tool to be Used					
			Grinding Wheel	Buffing Wheel	Wire Brush	Sanding Drum	Sanding Disc Diameter, Inches	Twist Drill Diameter, Inch (For drilling steel)
	1750 R.P.M.	3450 R.P.M.	Diameter by Width, Inches					
1/4	1/4	1/3	.....	.....	.....	.....	.....	3/16
3/8	1/2	3/4	4 by 1	6 by 1/2	6 by 1	4 by 2	7	1/4
1/2	1	1 1/2	6 by 1	6 by 1	8 by 1	5 by 2	9	3/8
5/8	2	3	8 by 1	8 by 1	8 by 2	6 by 2 1/2	9	1/2

bend at which the shaft can be operated without damage. This varies with the construction and diameter of the core.

The layers of wire in a flexible shaft tend to act like springs. Therefore, it is important that the shaft be rotated in the direction that tends to tighten the outer layer onto the layer directly below it. If the direction of rotation is known, a right-hand shaft should be specified for clockwise rotation, and a left-hand shaft for counter-clockwise rotation. Direction of rotation should always be determined from the power-source end of the flexible shaft. The torque capacity of a shaft in the unwinding direction is about 60 per cent that in the winding direction. For shafts that rotate in both directions, the torque must be reduced.

The torque ratings given by flexible shaft manufacturers are for shafts that are adequately supported along their lengths by clamps spaced approximately 3 feet apart. If no clamps are used, the shaft may bend into a knot unless lower torque is applied. As a safety factor for unsupported shafts, the calculated torque should be multiplied by 1.6, as done in the example given in Table 1. Torque ratings specified are for continuous operation, and when operation is intermittent, these ratings can be exceeded.

There are also other service factors that must be considered. Besides the starting torque, overload torques that might be encountered should be known. This is especially important where the flexible shaft is not large enough to transmit the full torque of the power source. Another factor that has to be considered for some applications is varying loads, such as encountered in conveyors. Here the flexible shaft must be designed to carry the maximum load the conveyor will handle.

Certain other conditions may preclude the use of standard shafts, and special shafts will be required. For example, where flexible shafting is exposed to severe corrosive conditions, stainless steel or other non-corrosive metal and a heavy rubber-covered casing must be used. In extreme cases, such as where the flexible shafting is operating immersed in water or other liquids, special seals must be used. Also, at extremely high tem-

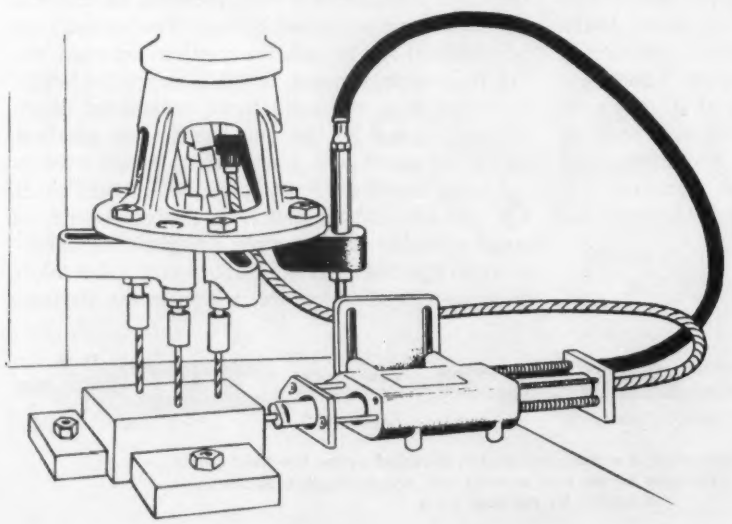


Fig. 4. Multi-Angle drill unit, driven by a flexible shaft from a vertical, multiple-spindle drilling machine, can be employed for drilling horizontal or angular holes

Fig. 5. Here, fins on the inner surfaces of small-diameter, cast-iron fittings are being removed by means of a grinding wheel mounted on a flexible shaft

peratures, the whole shaft, including the core, must be made of stainless steel. At very low temperatures, a special light grease must be used.

In power drive applications where both ends are held in place, no problems are encountered when selecting shafts up to 30 feet long. For portable tool applications, 20 feet is the maximum recommended length. Longer lengths are apt to cause slide type fittings provided in the end terminals to disengage. Actually, more problems are generally encountered with short shafts, where the bend requirements are usually more difficult to satisfy. The stiff sections formed by the end terminals must be subtracted from the total shaft length, and, if the radius of bend of the free length remaining is smaller than the minimum operating radius of the shaft, some design change must be made.

Flexible Shafts for Power Tools

If the power drive flexible shaft is going to be used with a grinding wheel or other accessories as a power tool, standard shafts can be selected

Fig. 6. Flexible shaft having a 1/4-inch diameter core is connected to a portable electric tool for drilling in remote corners or other inaccessible places that cannot be reached with the tool

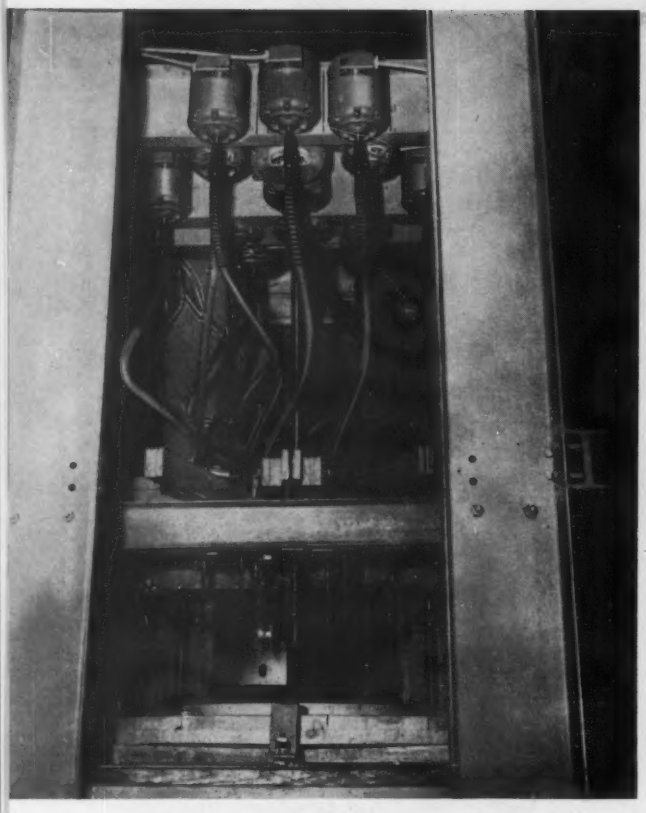


Fig. 7. In this special set-up, twelve flexible shafts—each connected to an electric motor—are used for multiple drilling different sizes of cable reels

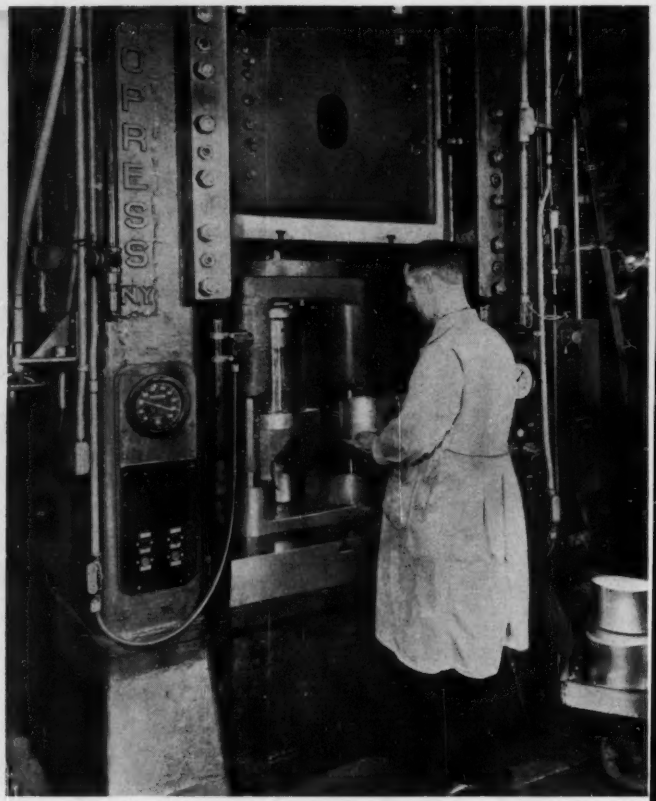


Fig. 8. Flexible shaft, seen at lower left, is employed for remote control of a valve on this hydraulic double-action press for deep-drawing aluminum

for this purpose. Charts are furnished by manufacturers showing the maximum size grinding wheels, buffing wheels, sanding discs, sanding drums, wire brushes, and drills that can be used with different size flexible shafts. Examples of such recommendations are given in Table 2. The 1/4-inch core diameter shafts are ordinarily used just for drilling, reaming, and filing. They are often connected to portable electric tools for drilling in corners that cannot be reached with the tools, as shown in Fig. 6. A special set-up for multiple drilling of cable reels is illustrated in Fig. 7. Here, ten 3/8-inch diameter and two 1/2-inch diameter, standard flexible shafts connected to individual electric motors are used. The jig for holding the drills can easily be changed for drilling different sizes of reels.

Remote Control Applications of Flexible Shafts

An entirely different method is used in selecting the correct size flexible shaft for remote control applications. Since speed is not a factor, the only points that must be considered when selecting the right shaft from graphs or tables furnished by the flexible shaft manufacturer are: the torque required, the total allowable deflection in degrees, and the radius of curvature of the smallest bend in the shaft.

The torque to operate the mechanism can be measured by torque wrenches or spring gages. The total allowable deflection is determined by the type of mechanism being controlled, and the degree of accuracy needed to operate it properly. The shaft selected must have a minimum operating radius smaller than the radius of the smallest bend in the shaft. To select the correct size core, first divide the total allowable deflection by the length in feet. This gives the allowable deflection per foot. Then, from the manufacturer's graphs or tables, select a core having a deflection per foot less than that required for the specified torque.

Remote valve control has become a common industrial use for flexible shafting. For this reason, manufacturers supply standard valve couplings and remote stations for flexible shafts from 3/4 to 1 5/8 inches in diameter. One example of flexible shafting being used for re-

mote valve control is shown in Fig. 8. On this hydraulic, double-action, deep-drawing press, an operating valve is remotely controlled by means of a flexible shaft, seen at the lower left on the press.

This article has been confined to standard flexible shafts with built-in bearings that can be selected directly from manufacturers' catalogues. However, for the designer who is interested in using flexible shafts in large quantities as an integral part of a machine, special flexible shafts can be designed that would eliminate the bearings, thus cutting costs considerably. In such cases, manufacturers of flexible shafts should be consulted for their recommendations.

* * *

Oil Derrick Put to Work at Plating Plant

A converted oil derrick hoists and lowers long tubes and rods into what is claimed to be the deepest hard-chromium plating tank in the country, at the Superchrome Engineering Co., Los Angeles, Calif. The 45-foot deep tank is set in a pit in the company's lot. It contains 2350 gallons of chromic acid solution.

It is possible to plate the inside of core and oil barrel tubes up to 43 feet in length and 6 inches in diameter with a deposit as thick as 0.008 inch, plus or minus 0.001 inch. External deposits up to 0.030 inch on the same work length, up to 2 1/2 feet in diameter, can also be made. Calender rolls for rubber, paper, and steel industries, weighing as much as 8 tons, are able to be handled.

* * *

Fritz Engineering Laboratory Dedicated

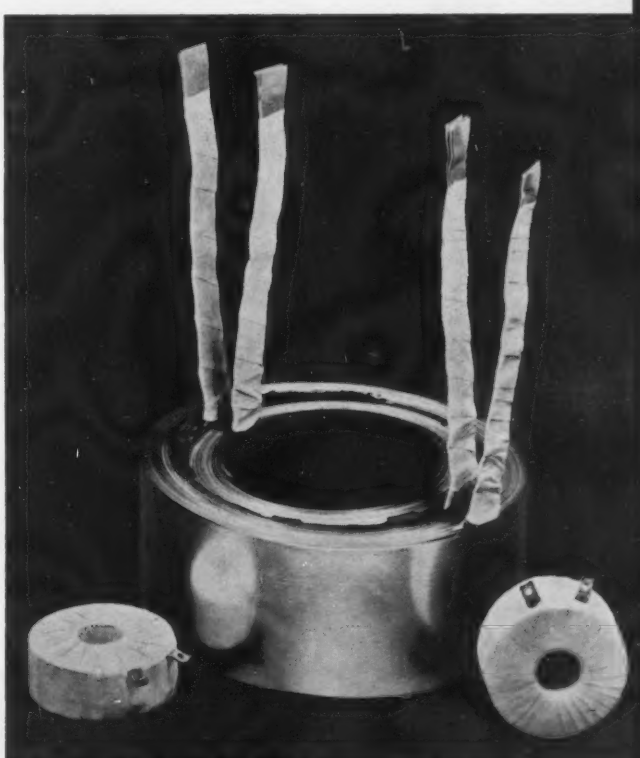
A new laboratory, known as the Fritz Engineering Laboratory, has been recently dedicated at Lehigh University, Bethlehem, Pa. Featured in this laboratory is a universal testing machine, claimed to be the largest in the world, that is capable of applying both tension and compression loads of up to 5,000,000 pounds. The height of this machine, which was designed and built by Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa., is 76 feet, 16 feet of this being below floor level. Specimens or structures up to 40 feet high can be tested. The lowest of six load-measuring scales, having a capacity of 20,000 pounds, indicates load variations of 20 pounds.

Electromagnetic Coils Wound from Aluminum Strip

A new development in the winding of electromagnetic coils for use in transformers, solenoids, and some motors and generators, is expected to substantially reduce the cost of the coils. In the new method, the coils are wound from strips of either aluminum foil or thin aluminum sheet instead of with conventional electrical wire.

Construction, and successful testing, of coils wound in this manner was announced by Reynolds Metals Co., Louisville, Ky. Spiral winding of coils with aluminum utilizes anodic coatings which serve as insulation for the strips of metal, replacing the paper, glass, or enamel insulation normally used with wire coils. The methods and materials employed permit the production of lightweight coils capable of operating at high temperatures due to excellent heat dissipation features. The anodic coating of aluminum oxide —a chemically inert material and an excellent electrical insulator—reduced the possibility of a coil "burning out," since the melting point of the coating is higher than that of the aluminum.

A corollary development has also been announced by the company—the use of conventional insulating materials such as polyester films. Coils insulated with this film offer advantages similar to those of anodized coils.

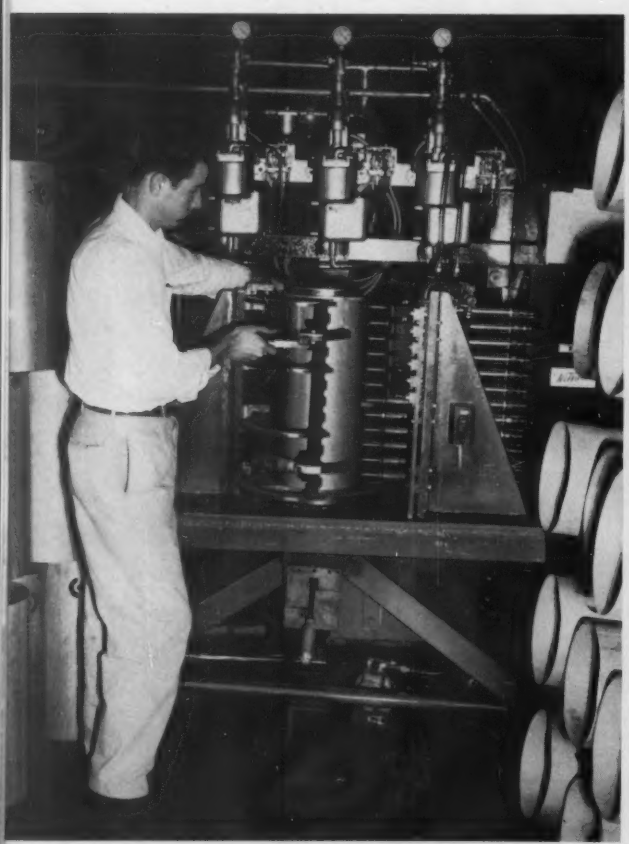


Large coil, wound with anodized aluminum strip stock, is for use in a 10-K.V.A. transformer. The small contactor coils are wound with aluminum foil insulated with a polyester film.

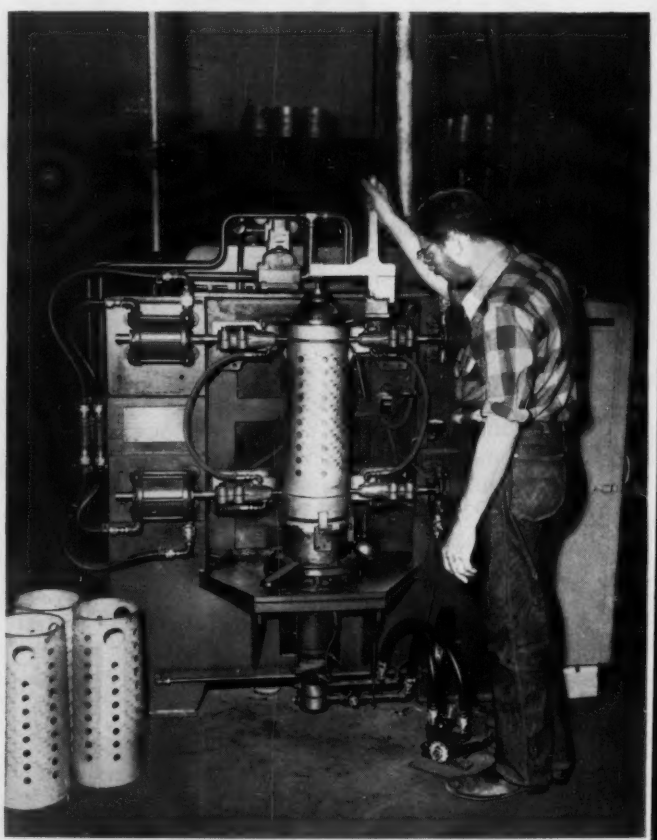
"Doing It Better" at Ryan

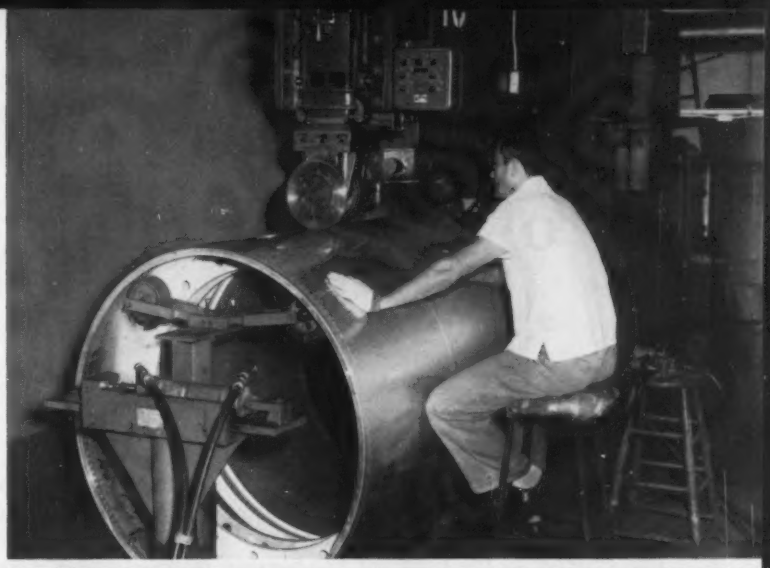
Through constantly improved methods, the Ryan Aeronautical Co., San Diego, Calif., is saving time, space, and material in production. These savings provide direct benefits in the form of lower costs for customers and higher wages for employes. Among the most interesting innovations in manufacturing methods are the techniques here illustrated. Four of them concern welding operations; the fifth, an assembly operation

Company-designed welder, employing hydraulically operated electrodes, simultaneously makes twelve spot-welds along seam of an outer combustion chamber for a jet engine. Expanding arbor keeps work cylindrical. In old method, spot-welds were made individually, and operator had to hold and align work manually.

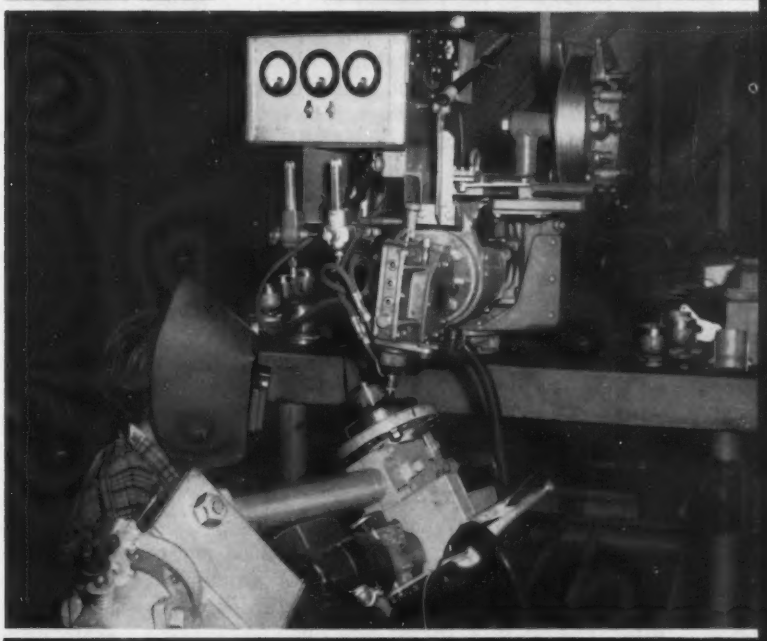


This special machine aligns, clamps, and spot-welds cap and exit body to inner-combustion chamber shell. Four spot-welds are made at the same time. Indexing type work-fixture permits thirty-two spot-welds to be completed from the initial set-up. Previous practice involved several separate operations and services of two employes.

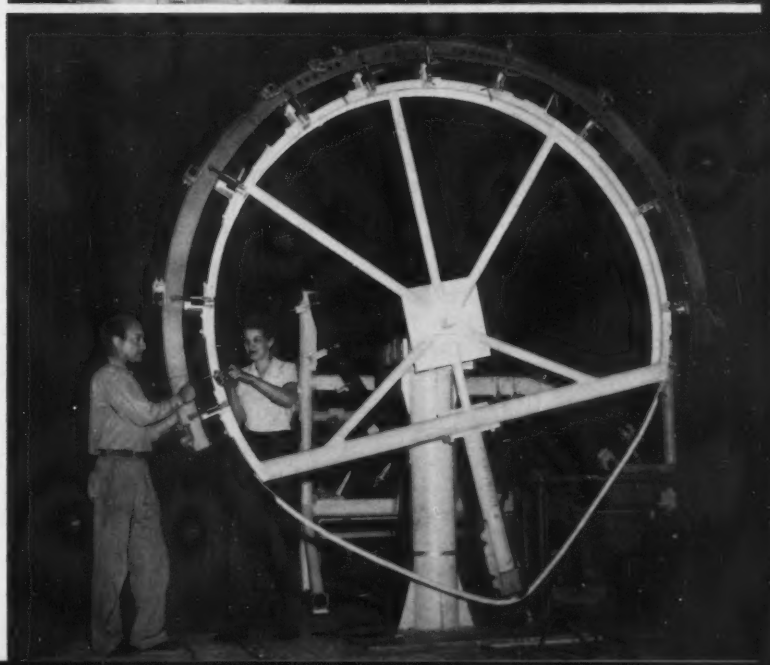




Roll-seaming two sections of large fuel tank on a Federal resistance welder. Pneumatic cylinder of supporting assembly in outer section yaws work when necessary during rotation, to keep seam from spiraling. Device is actuated from valve near operator. Formerly, a helper was required to stand by and yaw tank upon signal from operator.



Shielded inert-gas metallic arc (Sigma) welding stainless-steel nipples for exhaust systems. Welding time of seven seconds per part is remarkable contrast to the three minutes required when the manual arc-welding method was employed.



Fabricating a large fuselage frame member around a vertically rotating fixture. Only 55 square feet of floor space is required for the operation, in contrast to 150 square feet when a horizontal fixture was used. Vertical fixture also affords maximum access to both sides of part.

Selection, Care, and Installation of Anti-Friction Bearings

By E. P. STAHL

Garlock Packing Co.
Palmyra, N. Y.

IN SELECTING ball and roller bearings for general applications, two courses are open to the product designer. He may leave the problem entirely in the hands of the bearing manufacturer, or he may acquaint himself with the subject of bearings so that he will be conversant with their characteristics. This article, to be published in two installments, will be helpful to the designer as it will deal in a general way with the selection, care, and installation of anti-friction bearings.

Each of the many types of anti-friction bearings on the market today has certain individual advantages, and no one type is ideal for every application. In some applications one or more types may be successfully used, whereas in other applications only one type is clearly indicated. In fact, it frequently happens that the requirements of product performance and manufacturing economy can best be served by the use of two different types of bearings, as shown in Fig. 1. This application shows a typical mounting for a transmission-gear shaft. A cylindrical roller bearing *A*, located at the heavily loaded end of the shaft, carries a radial load. A single-row, snap-ring type ball bearing *B* is provided at the other end to take thrust and endwise locating loads as well as lighter radial loads.

So essential is anti-friction performance in today's machines and mechanisms that the earlier the bearings are selected in the preparation of the design studies, the better will be the performance and the lower the cost of the machine or mechanism. By familiarizing themselves with the standard types of bearings and their availability, capacities, and cost, the product designers can then plan intelligently and economically for the machines, mechanisms, or other equipment under consideration.

For example, an application may develop where misalignment of the bearing support or housing is in evidence. Such an application would call for a self-aligning ball or roller bearing, such as those shown in Fig. 2. With these bearings there is no need for boring the housing in accurate alignment, as is the case with rigid type ball and roller bearings. This feature of self-aligning bearings is, in some cases, the prime reason for their selection. Design *A* (Fig. 2) is a double-row internal type of self-aligning ball bearing which adjusts for misalignment resulting from errors in mounting or shaft deflection, without loss of capacity. The spherical bore of the outer ring permits the balls and inner raceway to swivel internally, thus compensating for misalignment of the housing or shaft deflection. Such bearings do not exert any bending influence on the shaft—an essential requirement for extreme accuracy at high speeds. This type is recommended for radial loads and moderate thrust loads in either direction. These bearings are generally used for applications such as woodworking machines, small hammer mills, fans, pillow blocks, and aircraft controls.

Design *B* shows a single-row, external type self-aligning ball bearing having a third separate ring. This ring has a spherical internal surface which permits the inner assembly to swivel on the outer aligning ring and thereby become square and true with the shaft and assembly.

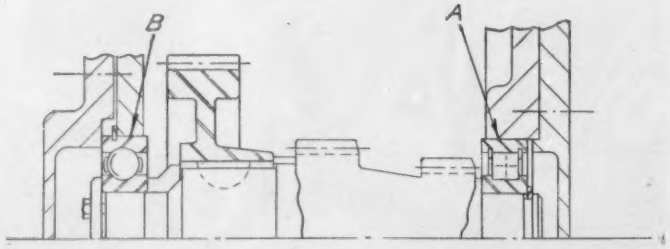


Fig. 1. Cylindrical roller bearing (A) carries the radial load, and ball bearing (B) takes the thrust and endwise locating loads on a transmission-gear shaft.

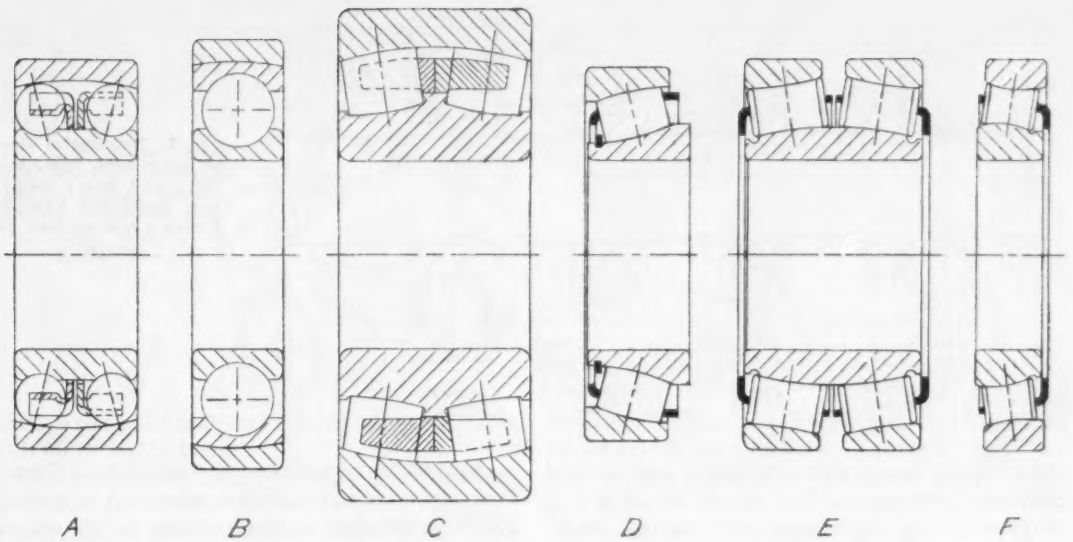


Fig. 2. Various types of self-aligning ball and roller bearings that are employed when misalignment of bearing support or housing is a problem.

Such bearings are recommended for applications requiring self-alignment where axial space is constricted but a larger outside diameter is permissible. Design *C* illustrates a double-row spherical roller bearing. This bearing has a high capacity and will support heavy radial loads as well as heavy thrust loads in either direction. Such bearings are suitable for steel-mill equipment, crushers, railroad journal boxes, fans, pumps, compressors, and similar applications.

A single-row, barrel type self-aligning roller bearing suitable for use in transmissions, gearboxes, and automotive axles is shown at *D* in Fig. 2. Unlike ordinary dual-purpose bearings, this type operates at full load-carrying capacity under conditions of misalignment. Design *E* illustrates a double-row, self-aligning roller bearing having concave rollers. In addition to supporting heavy radial loads, heavy thrust loads may be carried in either direction by this bearing. Design *F* shows a single-row, self-aligning roller bearing having concave rollers. Such a bearing can carry heavy radial loads when opposed to another bearing taking thrust loads.

In a product where trouble-free, anti-friction characteristics are desired, trial and error may eventually lead to the discovery of the ball and roller bearings that will do the job best. However, it is much easier for the bearing user to consult the bearing manufacturer or his field representative in the early planning stages of a design. Every anti-friction bearing application must be studied in detail before the proper type and size can be specified, because bearings selected for any machine or mechanism may influence the final design of many related parts and affect the ultimate performance of the machine in which they are used.

Classification of Bearings

For each bore size, most ball-bearing manufacturers and some roller-bearing manufacturers make bearings having several different outside diameters and widths, which are known as extra extra light; extra light; light; medium; and heavy, as shown in Figs. 3 and 4. Thus, for a given bore diameter or shaft size, there may be a choice of bearings having three or four different outside diameters or housing bores. Conversely, ball and roller bearings are available having the same outside diameters, but different bore sizes, as shown in Figs. 5 and 6. The trend in this country has been to discontinue the use of the heavy (400) series bearings, and to use instead light (200) and medium (300) series. Standardization of dimensions, as well as the versatility of ball and roller bearings, gives the product designer a wide range to select from.

Various types of commonly used ball and roller bearings other than self-aligning types are shown in Figs. 7 and 8. Other standard types of anti-friction bearings, some of which are designed to meet specific operating conditions, are seen in Fig. 9.

One of the most popular types of anti-friction bearings is the single-row, annular ball bearing seen at *A* in Fig. 7. Such bearings are designed to support both radial loads and substantial thrust loads in either direction, and are used ex-

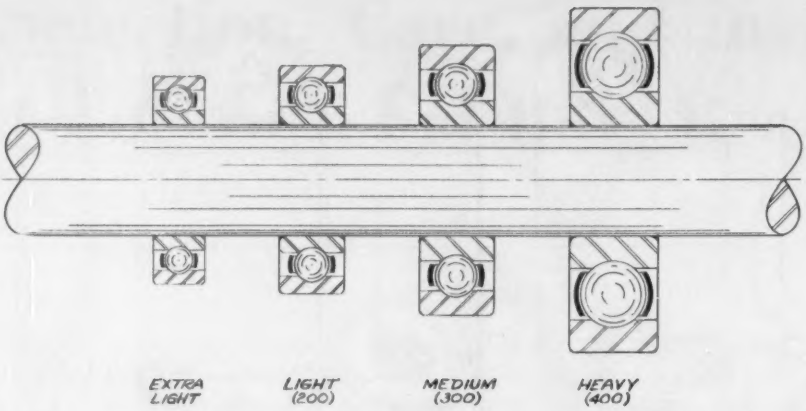


Fig. 3. Comparative sizes of extra light, light, medium, and heavy single-row, radial ball bearings having a common bore diameter.

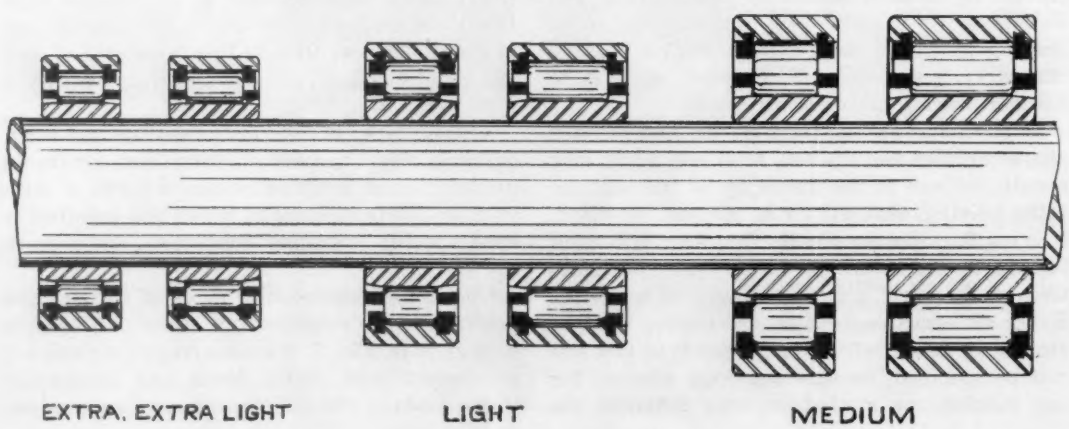
tensively in automobiles, tractors, and general industrial equipment. The one shown at *B* is a single-row, angular-contact ball bearing, which will support a heavy thrust load in one direction and a moderate radial load. When the sides of angular-contact bearings are ground flush, they can be mounted in three different ways—in tandem, back-to-back, or face-to-face. Such tandem assemblies have been successfully used for machine tool spindles, worm drives, and pumps.

Design *C* (Fig. 7) is a double-row ball bearing of the rigid type. This bearing has a high radial capacity because of its two rows of balls, and also a substantial thrust capacity in either direction. When loads are exclusively thrust or radial, a washer type ball thrust bearing such as the one shown at *D* can be used. However, for high speeds it is better to use radial or annular type ball bearings as centrifugal force tends to be a deterrent factor in the thrust-washer type. Thrust bearings are suitable for heavy loads at moderate speeds, and for applications where axial rigidity is desired. A typical use of washer type thrust bearings, applied to a worm-gear shaft mounting for a heavy-duty speed reducer, is shown in Fig. 10. In this set-up, single-direction, ball thrust bearings *A* are supplied at each side of the worm-gear hub to absorb the reversing and thrust loads, and cylindrical roller bearings *B* are employed to carry the radial load.

Miniature Ball and Roller Bearings

Miniature ball bearings, for anti-friction applications in constricted spaces, are available in four different types—radial, magneto, angular contact, and thrust, as illustrated in Fig. 11. These small ball bearings are similar in design and construction to their larger counterparts. Their importance in industry far outweighs their size, and it has been said that World War II could not have been fought with such success and dispatch without the aid of these small bearings in instruments and bomb sights. Miniature bearings are available having bores ranging from

Fig. 4. Cylindrical roller bearings having the same bore size are available in three different series, each series having two different width bearings.



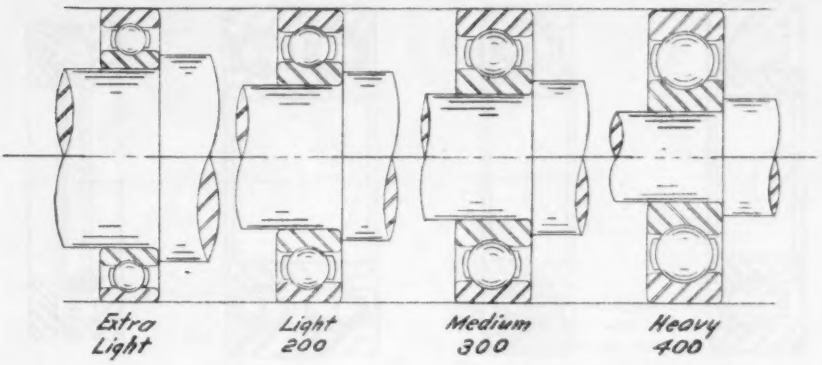


Fig. 5. Single-row, radial ball bearings having a common outside diameter are also available in extra light, light, medium, and heavy series.

0.0250 to 0.2500 inch and outside diameters from 0.1000 to 0.3750 inch.

The product designer's primary considerations in specifying miniature ball or roller bearings for precision applications are usually the same as for their larger counterparts. They are: appropriate physical dimensions, long operation, ample load capacity at the required speed, and low frictional torque. Radial and axial play are two ball-bearing characteristics frequently given little attention in the selection of miniature bearings. However, these two factors can be the source of troublesome and costly problems in sensitive instrument design where high precision is desired. The manufacturers of miniature precision bearings specify standard values on these clearances, but are prepared to furnish bearings with either larger or smaller clearances if requirements of the design indicate they are needed.

Miniature ball and roller bearings have brought to fine mechanisms the same properties of long wear and freedom from attention that are characteristic of larger ball and roller bearings. They have been used for drive movements in recording instruments, time clocks, seismographs, pendulums, gyroscopes, gyrocompasses, bomb sights, radar, and many other applications. Miniature ball bearings have operated at speeds as high as 120,000 R.P.M. The miniature roller bearing illustrated at *D* in Fig. 9 is a European development but is now made in this country. For applications where the load is primarily radial and space is constricted, miniature roller bearings have done a commendable job.

Ball bearings, which are generally considered the light-duty branch of the anti-friction family, are used in moderately loaded, high-speed applications where precision is of prime importance. Roller bearings are generally used for heavy-duty applications at low, moderate, and high speeds, where ruggedness and long-life expectancy are desired. For example, in high-speed, sensitive control instruments or mechanisms one would expect to find precision ball bearings, whereas on railway journals or the roll necks of a heavy-duty steel mill, roller bearings are generally applied.

Metric dimensions have always been used in the manufacture of ball bearings in Europe, and they are also used in this country for ball bearings, as well as for some narrow, cylindrical roller bearings having boundary dimensions interchangeable with single-row ball bearings. However, a number of cylindrical roller and tapered roller bearings are made to inch dimensions to conform with present-day design and machine practice.

The trend in American machine design since World War I has been to use ball and roller bearings with lighter cross-sections and narrower

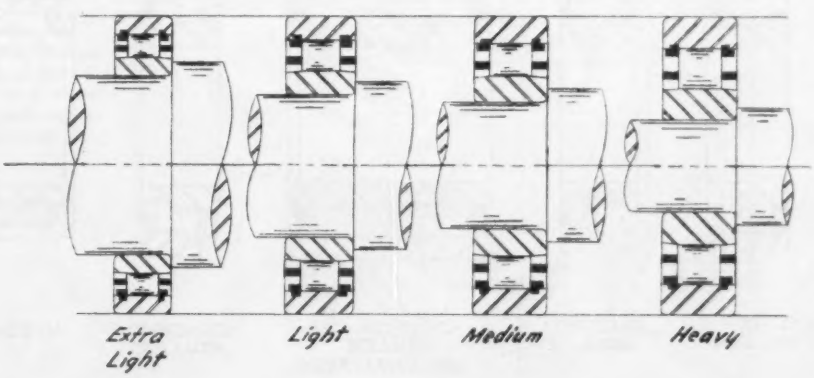


Fig. 6. For a given bearing outside diameter or housing bore size, cylindrical roller bearings can be selected in any one of four series.

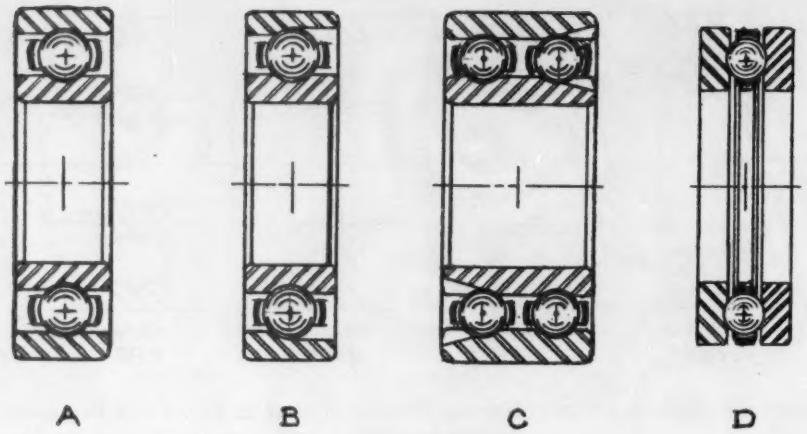


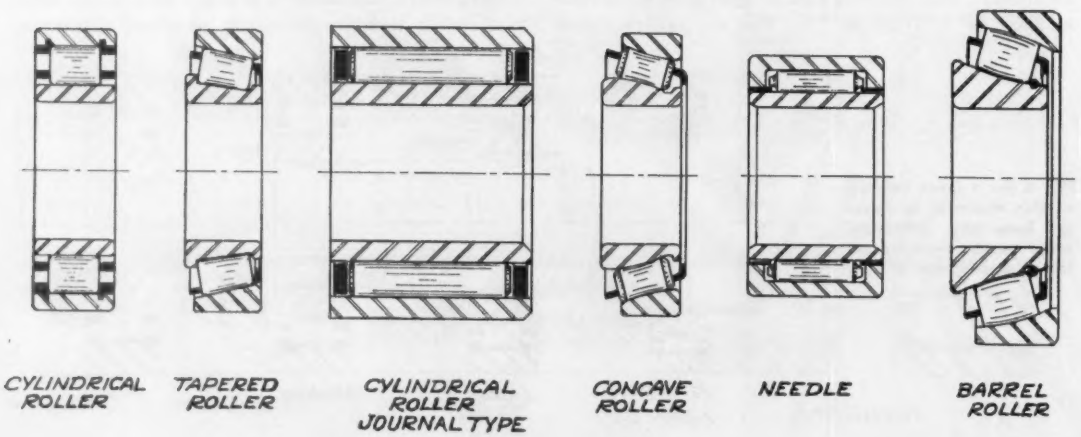
Fig. 7. Various types of ball bearings, in addition to the self-aligning types shown in Fig. 2, which are commonly employed for anti-friction application.

widths to condense space requirements, reduce weight, and lower costs. This trend is made possible by the use of better steels, improved heat-treatment, and smoother surface finishes, which permit the bearings to carry heavier loads at higher speeds.

In selecting a size and type of anti-friction bearing for a given design, the product designer is often desirous of knowing the relationship between the bearing bore (shaft size), outside diameter, and width. To provide the required capacity for a given bore and outside diameter, different widths of ball and roller bearings are available as standard units. Five different width series are provided: 0, 1, 2, 3, and 4. This relationship is shown graphically in Fig. 12. From this diagram, it can be seen that ball and roller bearings having the same bore size are available in different outside diameter and width series. Through this standardization, a wide range of properly designed and proportioned bearings has been established. Also, dimensional interchangeability between the different types of bearings is obtained.

The rollers in narrow cylindrical roller bearings have a length equal to their diameters. These bearings are made in a variety of types, as illustrated in Fig. 13, and provide a high radial-load capacity, large overload capacity, and resistance to shock and vibration. True rolling action with out skewing is insured, and the bearings lend themselves to high-precision manufacture and easy assembly. The high radial-load capacity permits compactness of design, since smaller size bearings can be used for a given load condition or shaft diameter. Loads are distributed over a comparatively large area, thus minimizing raceway deformation. Precision manufacture and short, parallel roller construction permit high-speed operation. Since there is no adjustment required in these bearings, the desired fit is obtained with the requisite internal clearances provided by the bearing producer during their manufacture.

Fig. 8. Common types of roller bearings include cylindrical, tapered, journal, concave, and needle. Concave and barrel types are self-aligning.



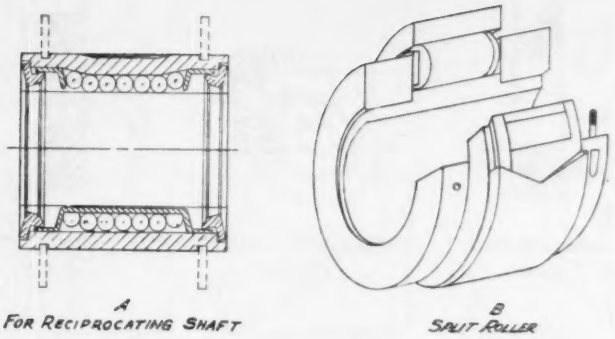
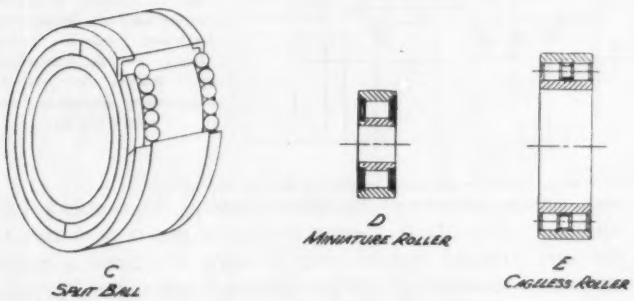


Fig. 9. Many special operating conditions can be met with these standard bearings. For example, the ball bushing at (A) is used for reciprocating shafts.



All the narrow cylindrical roller bearings illustrated in Fig. 13 have different outer and inner race constructions to meet various operational and design requirements. The bearings shown at *E* and *F* have maximum radial-load carrying capacity. Designs *A*, *B*, *C*, and *D* have separable races, either outer or inner. Bearing *A* has a separable outer race; *B*, a separable inner race; *C*, a separable outer race, and *D*, a separable inner race. Separable races give such bearings a distinct advantage for automotive, tractor, and similar applications involving heavy radial loads and light thrust loads. The separable race is free to "float" laterally to compensate for machining, assembling, and temperature variations.

Bearings with one separable race removed can be mounted independently on shafts or in housings at various locations in the factory, and then brought together at final assembly. The use of cylindrical roller bearings with separable races

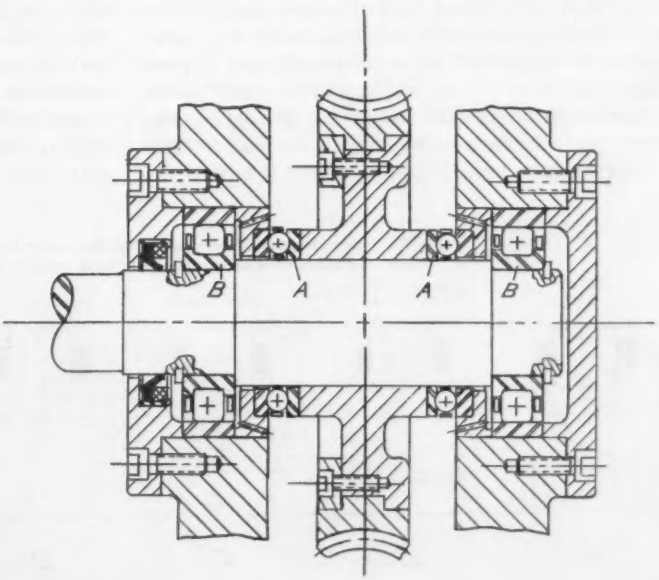
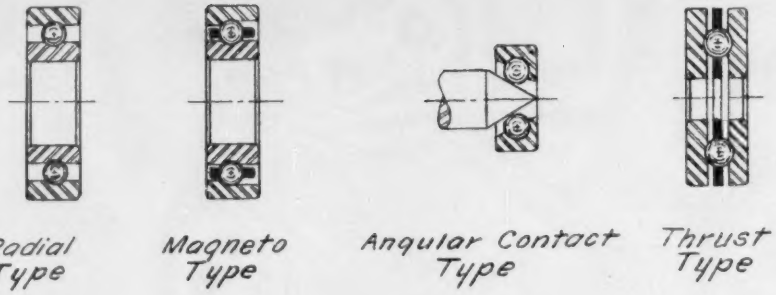


Fig. 10. Heavy-duty speed reducer is equipped with ball bearings (A) to absorb reversing and thrust loads, and cylindrical roller bearings (B) for radial loads.

Fig. 11. (Right) Miniature ball bearings, available in radial, magneto, angular contact, and thrust types, are used for anti-friction applications in limited spaces.



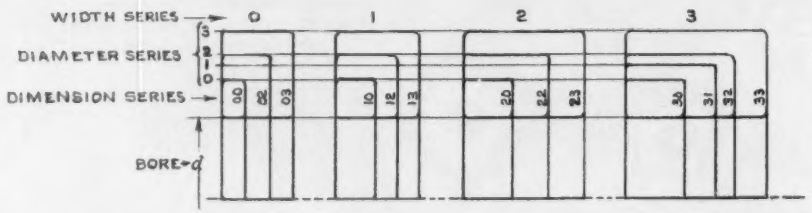


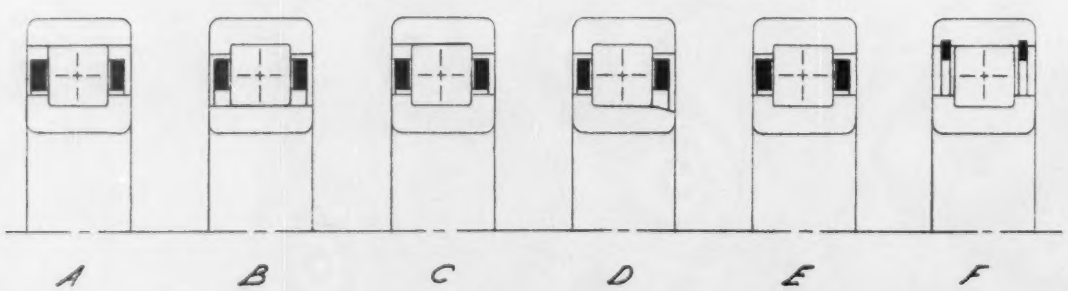
Fig. 12. (Left) Graphical comparison of relationship between bores (shaft sizes), outside diameters, and widths for various dimension, diameter, and width series.

is further enhanced by the fact that one race can be omitted from the bearings for certain applications, as seen in Fig. 14. In such cases, the surfaces of the shafts and housings in contact with the rollers should be hardened and ground to the bearing manufacturer's specifications. When this can be done economically, considerable savings can be effected. For example, with inner races removed, larger diameter shafts or smaller size bearings can be used, resulting in greater shaft rigidity or savings in bearing costs.

Design *A* (Fig. 14) shows a partial bearing assembly consisting of a roller assembly and outer race designed to operate on a hardened and ground shaft. A roller assembly only, operating on a hardened and ground shaft and in the hardened and ground bore of a spur gear, is seen at *B*. Design *C* shows a roller assembly and inner race for operation in a hardened and ground housing bore. A roller assembly designed to operate in a special bolted-on, hardened and ground outer race or housing is seen at *D*. This design can be used in places where it is not possible or practicable to extend the housing sufficiently to form a cavity or recess in which to mount the bearing. Design *E* shows a roller assembly for operation on a hardened and ground shaft, and in a hardened and ground housing bore. A segment of a tractor transmission assembly in which partial cylindrical roller-bearing assemblies are used is seen in Fig. 15.

Cylindrical roller bearings with separable races lend themselves to applications where races are omitted more readily than ball bearings, due to their straight, parallel, and simple construction. However, there have been instances where inner rings have been omitted from ball bearings to simplify and condense the design, and reduce cost. In such applications, the manufacture of the shaft or part on which the balls operate is better left to the specialist. One example of a ball-bearing application with the inner race omitted is shown in Fig. 16. This is a fan and pump-shaft assembly used in automobiles and tractors, with synthetic rubber seals provided at both ends. The bearings can be mounted in a

Fig. 13. Various types of narrow cylindrical roller bearings having different outer and inner race constructions to meet specific design requirements.



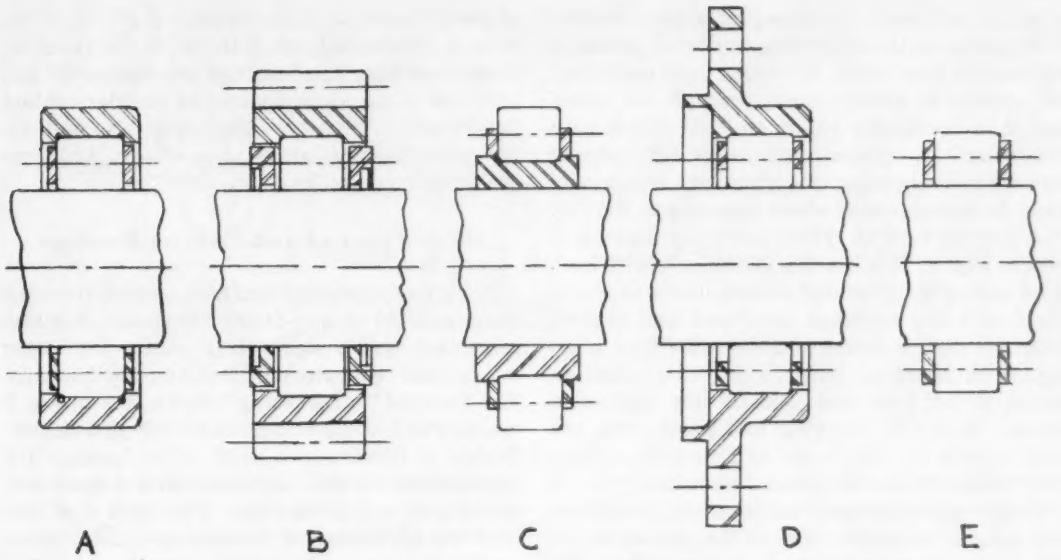


Fig. 14. Cylindrical roller-bearing applications in which one or both races have been omitted to permit smaller space requirements or the use of larger shafts.

straight hole bored through to a locating shoulder and requiring no facing. Closure caps on the bearings are not required for this type of simple, compact assembly.

Miniature radial ball bearings have been used on typewriter rolls, with the bearing inner races omitted as shown in Fig. 17. In design *A*, the shaft is grooved, while in design *B*, the balls roll on a straight shaft.

A common type of precision roller bearing is the single-row, tapered design. Such tapered roller bearings are designed to carry both radial and thrust loads, either separately or in combination, and can be adjusted either through the cups (outer races) or the cones (inner races). This adjustable feature is an outstanding advantage in that it permits accurate control of the bearing running clearance. Also, the bearings can be preloaded for applications where minimum deflection, extreme rigidity, or positive location of the shaft is desired, as in certain machine tools.

Single-row, tapered roller bearings may be mounted by either of two methods: direct or indirect. In the direct mounting, the large ends of the rollers of both bearings point toward each other (inward). This mounting is preferable where the load source is located between the bearings, for example, in general-purpose gear reducers, transmissions, and automotive rear axles. In applications of this kind, the cups are usually made the adjustable member. Such an application is often called an "adjustable cup mounting."

In indirect mounting, the large ends of the rollers point away from each other (outward). This type mounting has greater stability for short bearing spreads, and is preferred for wheels and similar applications where short axles

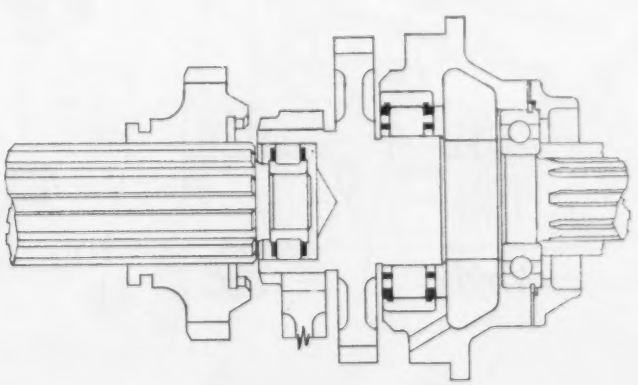


Fig. 15. Outer race has been omitted from bearing at left—and inner race from bearing at right—in this segment of a tractor transmission assembly.

or shafts are used. It is also preferable for overhung loads, as in supporting the bevel pinion of automotive rear axles. With this type mounting, adjustment is usually made through the cones, and it is frequently called an "adjustable cone mounting." A typical application of indirect tapered roller-bearing mounting for a pneumatic-tired farm-implement wheel is shown in Fig. 18.

A journal type of cylindrical roller bearing is seen in Fig. 8. This bearing is available with both solid and helically wound rollers, and was one of the first roller bearings developed and evolved from the early cageless or loose-roller type bearing. Such bearings have found wide usage in industry, and have been successfully applied to cranes, steel-mill charging and ingot cars, ore cars, wheels for lift dams, and similar applications where the load is primarily radial.

Single-row roller bearings with concave rollers and convex raceways, such as the one shown in Fig. 8, also carry radial loads when applied with another bearing taking the induced thrust loads. Such bearings can carry one-directional thrust or combined loads, and multiple types carry heavy loads in either direction when mounted in pillow blocks.

The needle bearing also shown in Fig. 8 is designed to carry heavy radial loads without taking up a large space radially. In barrel type roller bearings, the large contact between rollers and races provides high load capacity with good distribution. Unlike ordinary dual-purpose bearings, these barrel type bearings operate at full load-carrying capacity under conditions of misalignment.

A typical rear-axle, automobile and truck differential with barrel type bearings on either side of the differential is illustrated in Fig. 19. In this type of differential, wheel thrust is also taken on these bearings. The bearings are assembled and adjusted in the same manner as angular-contact ball bearings. This type bearing is also suitable for transmissions, gear-cases, wheels, and general industrial applications.

Other Types of Anti-Friction Bearings

Since many rotating shafts in modern industry are supported on anti-friction bearings, it is also important that reciprocating shafts for linear movements be mounted on anti-friction bearings. The so-called "ball bushing" shown at *A* in Fig. 9 makes this feasible and commercially practicable. Design *B* illustrates a split roller bearing for applications where it is impossible to use solid or continuous roller bearings. The split does not limit the application of the bearings, and permits assembly around instead of over the end of a shaft.

Fixed split roller bearings, sometimes called grooved-race types, are used for shaft locating and radial thrust. Expansion split roller bearings, sometimes called "floating" types, are used to accommodate end play and shaft expansion. These split roller bearings have been used successfully in pillow blocks, and on connecting-rods, cranes, and trunnions, as well as many other applications. There is no need to remove gears, pulleys, or couplings from the shafts to apply these bearings, thus facilitating assembly and disassembly, and reducing costs.

Design *C*, Fig. 9, shows a thin-section, split ball bearing suitable for applications where some integral part of the mechanism is an obstacle to

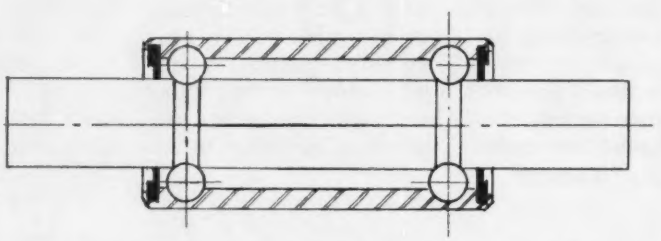


Fig. 16. (Right) Fan and pump-shaft assembly for an automobile uses a double-row ball bearing with the inner race omitted. Balls operate on the shaft.

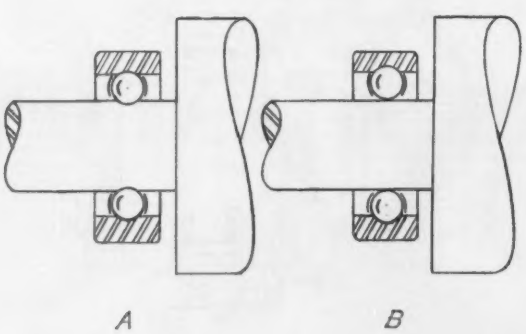


Fig. 17. (Left) Miniature ball bearings have been applied to typewriter rolls with inner races omitted. Balls can roll in grooves or on straight shaft.

A *B*

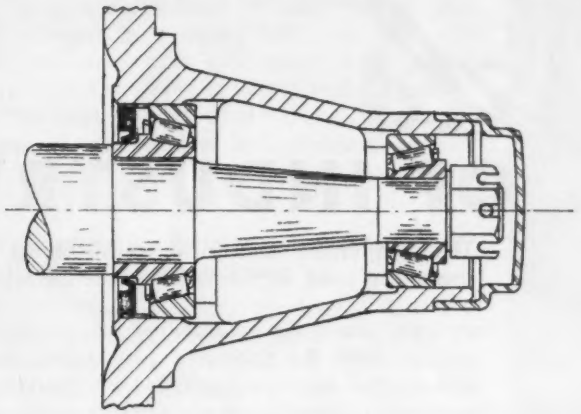


Fig. 18. Farm-implement wheel mounting is provided with indirectly mounted tapered roller bearings, having large ends of rollers pointing away from each other.

the use of a solid bearing. Typical applications are the center main bearings of cranksnafts, as in pumps, internal combustion and steam engines, textile machinery, printing presses and refrigerating machinery. A new type miniature cylindrical roller bearing is seen at *D*. These bearings are available with bore sizes ranging from 5/32 to 25/64 inch, and outside diameters ranging from 0.4724 to 1.0236 inches, in three types. One type has a separable outer race; a second is shielded with a separable inner race; and a third is a shielded, self-contained unit with inner races permanently assembled. This latter bearing permits location of the shaft axially, provided axial loads are light. Such miniature bearings are suitable for use in all kinds of instruments and other equipment where a small, high-capacity bearing is desired in a constricted space.

A high-capacity, thin-section cageless needle bearing is illustrated at *E* in Fig. 9. The rollers in these bearings have center grooves, and are prevented from skewing by a center guide rail in the races, thus eliminating any tendency to bind. Such bearings are available in shaft sizes ranging from 0.375 to 1.6875 inches, and outside diameters ranging from 1.125 to 2.5625 inches.

A second and concluding installment of this article, to be published in an early issue of MACHINERY, will describe the sealing, care, and installation of anti-friction bearings.

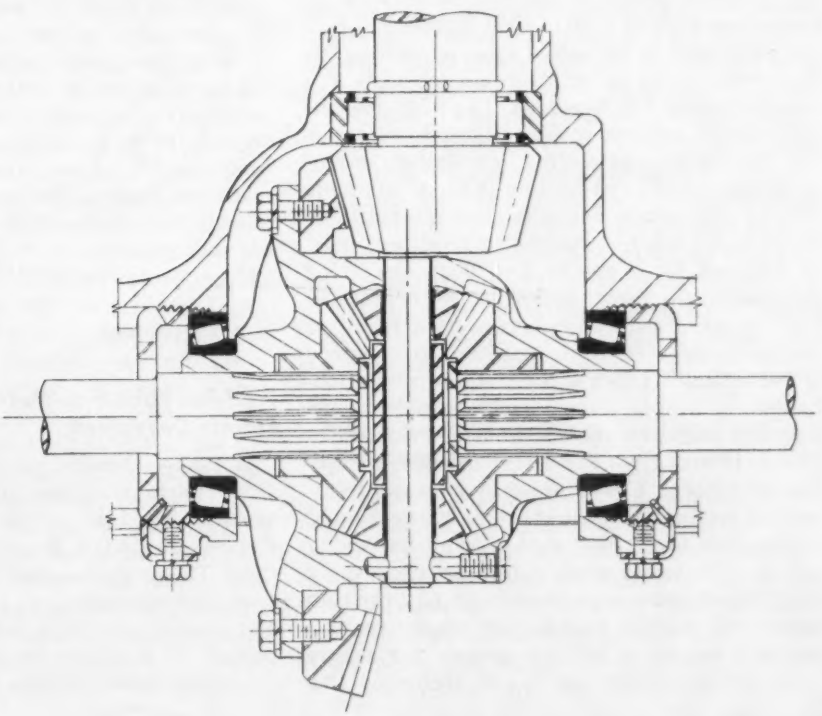


Fig. 19. This rear-axle, automobile and truck differential is equipped with barrel type roller bearings which permit misalignment.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Stainless Steel Hardenable by Sub-Zero Cooling or Double Aging

A stainless steel that is soft and ductile and readily fabricated in the initial condition and then hardenable by heat-treatment at a temperature low enough to prevent excessive scaling or distortion has been announced by the Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa. Designated as "AM 350" this steel in the hardened condition exhibits high impact strength at low temperatures as well as good corrosion resistance. This alloy both with respect to composition and method of heat-treatment bridges the gap between the 300 and 400 series of stainless steels. The nominal composition is as follows: carbon, 0.08 per cent; manganese, 0.60 per cent; silicon, 0.40 per cent; chromium, 17.0 per cent; nickel, 4.2 per cent; molybdenum, 2.75 per cent; and iron, the balance.

AM 350 is annealed in a manner similar to the standard grades of stainless steels with an annealing range of 1700 to 1950 degrees F. Sheet and strip may be air-cooled after annealing, but it is desirable to oil or water-quench plate and bars to insure low hardness. The alloy may be hardened by sub-zero cooling followed by tempering. This is done by cooling to a temperature of —100 degrees F. and holding it for a minimum time of two hours. For maximum strength and ductility the sub-zero hardening treatment must be followed by a one to two hour tempering treatment in a range of 750 to 900 degrees F. Only slight discoloration occurs as a result of the tempering treatment. An alternative method of hardening involves a two-stage precipitation-hardening heat-treatment called double aging. The first stage is a one to two hour treatment at 1300 to 1400 degrees F. Further increase in hardness and strength is obtained by a second treatment of one to two hours at 800 to 900 degrees F.

The alloy has a high rate of work hardening and at room temperature after sub-zero cooling and tempering has a yield strength (0.2 per cent offset) of 152,000 pounds per square inch, a tensile strength of 198,000 pounds per square inch, and an elongation in two inches of 13.0 per cent. Double-aged AM 350 at room temperature exhibits the following properties: yield strength (0.2 per cent offset), 144,000 pounds per square inch; tensile strength, 174,000 pounds per square inch; and an elongation in two inches of 14.0 per cent.

Although designed especially for use in the aircraft industry, other applications include such items as flat and coil springs, corrosion-resistant fasteners, dental and surgical equipment, saws and saw blades, piston-rings, glass molds, pump parts, camera parts, and cutlery.

Chromium Containing Steel Provides Abrasion Resistance

In providing a steel with great wear and abrasion resistance the Vanadium-Alloys Steel Co., Latrobe, Pa. has helped to meet the needs of the refractory and ceramics industries. "Chromewear," as this alloy is called, is said to have an abrasion resistance approximately five times that of air hardening, high-carbon high-chromium type steels.

This alloy can be heat-treated to a very high hardness and is tough enough for most tool applications. Its use should be confined to applications where machining and grinding requirements are relatively simple. The nominal composition of this alloy is: carbon, 2.30 per cent; silicon, 0.40 per cent; manganese, 0.70 per cent; chromium, 5.25 per cent; vanadium, 4.75 per cent; molybdenum, 1.10 per cent; tungsten, 1.10 per cent; and iron, the balance.

Precision Rubber-to-Metal Bonding Process Developed

A rubber-to-metal bonding process that provides parts that are precise, flash-free and smooth, has been developed by the Stillman Rubber Co., 5811 Marilyn Ave., Culver City, Calif. The process, known as "Permadizing," has been used successfully to bond aluminum to various rubber, synthetic rubber or silicone compounds. It is a high production process giving consistent variation-free results even over the

longest runs. Permadized parts exhibit low swell, are resistant to aromatic fuels and hydraulic fluids and can be made corrosion-resistant. A use to which this process can be put is the making of aircraft engine parts where extreme operating ranges of temperatures and pressures are encountered.

Thin Film Provides Protection and Lubrication to Metal Surfaces

A very thin protective lubricating film that provides corrosion protection and moisture repellency has been developed by the American Grease Stick Co., Muskegon, Mich. "R-12 Protective Coating," which is the designation given this coating material, provides a high film strength long-wearing lubricant which will not drip or run at 200 degrees F., gum or harden at —20 degrees F., or leach out when exposed to weather. Application is made with any suitable oiler, spray gun, brush or cloth, or by dipping. It is effective on all types of metals.

Mesh Type Abrasive Product Resists Filling and Loading

A cloth mesh coated on both sides with mineral grains bonded to the cloth with a heat-resistant waterproof resin, which can be used for either wet or dry hand or machine sanding, has been made available by the Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn. The product, called "Wetordry Fabricut," is available coated with aluminum oxide or silicon carbide grits. It has a "self-cleaning" action which minimizes filling as the stock being removed passes through the openings in the mesh. If the mesh does become clogged it can be blown clean with compressed air. The abrasive cloth is available in coarse to fine grits, ranging from 100 to 400.

Emulsion Cleaner for Ferrous and Non-Ferrous Metals

An emulsion cleaner used in circulating systems for removing foreign substances from metal sheets prior to final processing has been offered by the Brooks Oil Co., 934 Ridge Ave., Pittsburgh 12, Pa. "Brooks Rollene E.C.," as the cleaner is called, removes such foreign substances as grit, dirt, fine metal particles, and other contaminants which may have been picked up in handling. Cleaning of the metal surface is accomplished by means of a penetrating action. The cleaner gets under the foreign matter and floats it away. The film which remains is non-corrosive and acts as a lubricant for any subsequent drawing operation.

This drop-hammer die has a 3/8-inch to 1/2-inch modified "Epocast" plastic facing which together with the punching face, also made of this compound, facilitates the making of wrinkle-free surfaces.

High Impact Resistant Drop-Hammer Die Material

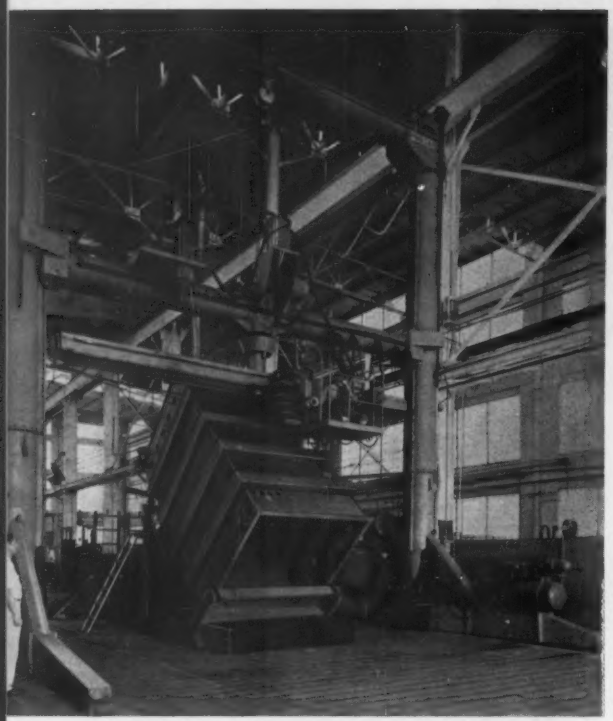
An impact-resistant plastic tooling compound suitable for drop-hammer dies has been made available by Furane Plastics Inc., 4516 Brazi, Los Angeles, Calif. The compound, designated as a modified "Epocast," is made from a combination of liquid epoxy resin and a polysulphide liquid polymer. The accompanying photograph shows a drop-hammer die used for forming an aluminum-alloy part. The body of the die is constructed of Kirksite with a 3/8-inch to 1/2-inch thick facing of the plastic compound. The punching face also made of the plastic compound exhibits resilience and high impact strength and has a durometer hardness of 80 to 95. The hardness of the die face is considerably greater.

Stainless-Steel Wire Offers Workability and Uniformity

Springs with unusually strong fatigue life can now be made by using Blue Label Stainless-Steel Wire, Type 302 with a more restricted analysis range, which has been developed by the Webb Wire Division of The Carpenter Steel Co., New Brunswick, N. J. Designed primarily for use in the production of springs, it is also suitable for other types of wire forms.

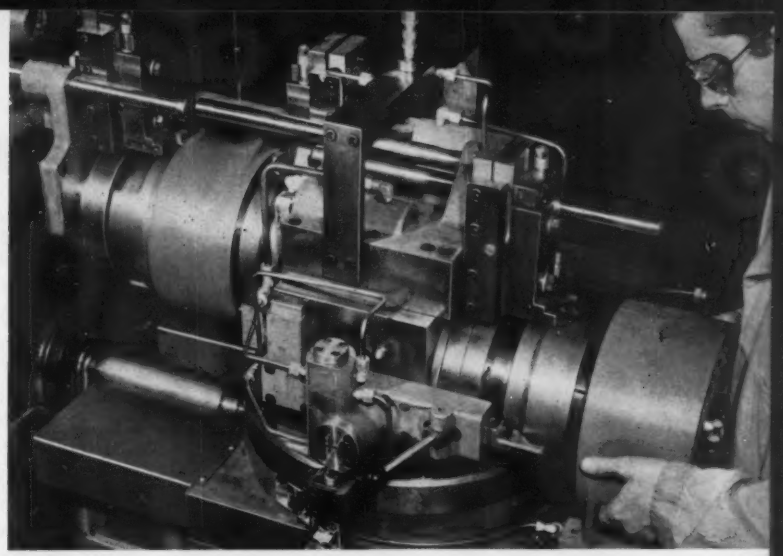
In Shops Around the Country

Camera highlights of some interesting operations performed in various metal-working plants



Transformer tanks are welded from a Pandjiris self-propelled gantry in the Mount Vernon, Ill., plant of the Wagner Electric Co. The operator travels with the welding head, which is controlled from a push-button station. A 20-foot circle can be welded without moving the gantry over its rails.

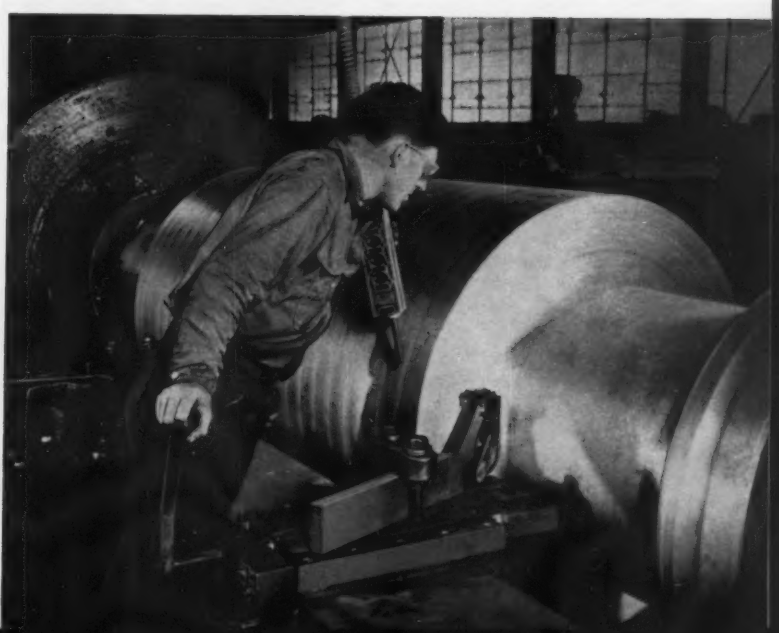
Automobile bumpers emerge from a hot-water rinse at Chevrolet's spring and bumper plant in Livonia, Mich. The rinse is part of a Nankervis automatic plating installation one-third mile long. Bumpers, completed at a rate of one every three seconds, go through forty-one pre-cleaning, plating, reclaiming, and rinsing operations.



Rabbeting both sides of electric motor frames simultaneously on a Gisholt No. 12 automatic lathe. Indexing turret accommodates two work-pieces, so that while one is machined the other is loaded or unloaded. A driver on the machine spindle rotates the work-arbor. Tool-slides on turret and headstock are actuated by longitudinal feed movement of the turret carriage.

Spray-painting small detail parts in a tumbler rig at the Glenn L. Martin Co., Baltimore, Md. The rig consists of a small drum having baffles and a detachable screen at one end and an opening at the other. Held on two brackets, the drum is rotated by a portable air motor. At six-second intervals, paint and air are sprayed alternately through the opening.

Cold-working the fillets of cast-steel backup rolls to increase tensile strength, in the Rolls Division of the Blaw-Knox Co., Pittsburgh, Pa. Tool used consists of a wheel, positioning apparatus, and gage to register pressure applied. Technique discourages crack formation in fillets and prolongs roll life.



Automatic System for Machine Control

AN AUTOMATIC control system has been developed by the Industrial Controls Corporation, Chattanooga, Tenn., to provide a relatively simple, accurate, and reliable electronic device for automatic operation of milling machines, lathes, presses, grinders, borers, and similar machine tools, from information on a tape or other record. The tape can be punched, printed, magnetized, embossed, or made conductive or capacitive to store the information desired. The information can be sensed by means of photocells, magnetic pick-ups, contacts, or capacitors. At present photocells are being used as sensing components.

The control system is based upon a special step motor. This motor rotates in small steps or increments and is magnetically locked in position when stopped so that there is no over-travel. This prevents free wheeling and makes it possible to employ the motor as a combined indexing and power device for producing definite displacements specified.

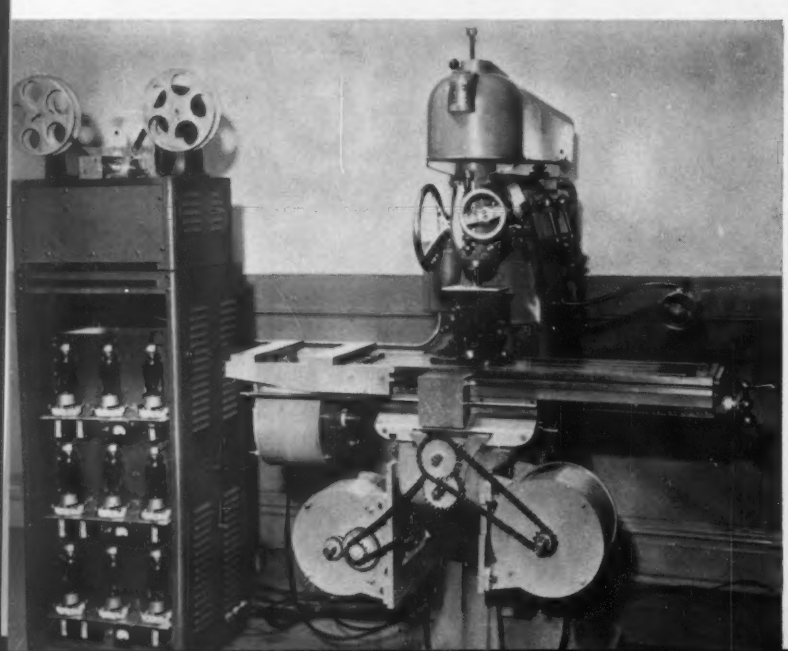
By means of suitable gearing, each step movement of the motor can be made to move a cutting tool, or any other member of an automatic system, a small fraction of an inch (such as 0.0001 inch or less). The number of steps may be chosen to meet specific requirements. For example, in an automatic control that has been applied to a milling machine there are 108 steps per rotor revolution, the gearing being chosen so that one step movement displaces the cutting tool slightly less than 0.001 inch. This provides a relatively smooth cut of any desired shape.

Another feature of the step motor is that it can be reversed in a fraction of a second, when operating at moderate speeds. Also, when used with the associated servo system or control system and a special mechanism, there is no hunting.

A three-dimensional, automatic milling machine control has been built, using three of the step motors. One motor controls relative vertical movement between the cutting tool and work-piece, and two others control movement of the table along mutually perpendicular axes in a horizontal plane. There are nine thyratrons controlling current to the motors and six photocells for sensing the punched, printed, or photographed tape, which, in this case, comprises 35-millimeter motion picture film. A small motor drives the film across six small windows which admit light from a showcase type lamp to the respective photocells, when a punched hole or clear portion of the type or film is in register with a window. The tape therefore acts to modulate the light reaching the photocells in accordance with the desired pattern printed or punched in the tape. Change of speed of the tape does not alter the shape of the work-piece cut by the milling machine, but merely changes the rate of cutting.

Since each mark or characterization of the tape causes one step movement of the associated motor on the milling machine, the latter will reproduce the configuration corresponding to the marks on the tape. The longitudinal spacing of the marks determines the step-motor speed. A fourth step motor can be used to rotate or shift the work-piece, and additional step motors may be employed for other purposes.

The three-dimensional, automatic milling machine control is simple in that it has only nine thyratrons and six photocells, plus several small tubes and relays. The milling machine control has been provided with an automatic backlash compensator, which need be set only once. An important adjunct of this automatic tool control system is a machine which either manually or automatically traces a drawing or template, simultaneously printing or punching a tape.



Milling machine equipped with automatic control system. Three-step motors control movement of the work-piece

Surface Grinding Adaptable to Automation

WHEN design of the work-piece permits, surface grinding offers many advantages for machining small, medium, and large surfaces. Today, this method of finishing is being adapted to automation in many plants requiring high-volume production. Modern, high-powered grinders overcome many of the former limitations of grinding as a stock removal operation. Also, improvements in grinding wheels permit them to compete favorably on many jobs.

In single-pass surface grinding, where parts are finished in one operation by a progression of roughing, semi-finishing, and finishing cuts in a multiple-spindle machine, automatic controls enhance the inherent economies of automation. Important advantages of grinding in automation are that the cutting tool is self-sharpening, and the machine is easily equipped to accurately and automatically compensate for, and control wheel wear. The down time factor—a major problem on most machines designed for highly integrated production processes—is easily controlled because wheel life is predictable.

Successful application of automatic surface grinding depends on four requirements: first, surfaces to be machined must be accessible to the wheel; second, work-pieces should be designed so large surface areas are relieved where permissible; third, stock removal should not exceed 0.150 inch (depending on the size of the surface area); and, fourth, high-volume production is desirable to make sure that the capital investment is profitable.

An example of high-powered, single-pass, automatic grinding is the connecting-rod job illustrated in Fig. 1. Two surfaces on one side of the rough forgings are ground to two different heights at the rate of 1500 pieces per hour on this Mattison (Hanchett type), rotary, automatic surface grinder. Parts are secured on a table which rotates under the five grinding spindles. Two wheels are used to rough- and finish-grind the pin ends, and the other three progressively finish the crank ends. Accuracy of step and parallelism are held within 0.001 inch.

Conveyor equipment carries the parts to the machine. Projections on the holding fixtures are provided so automatic handling devices may be used to load and unload the rods. Cams actuate the automatic, mechanical clamping and unclamping of the work-pieces, as seen in Fig. 2. Table rotation is continuous, with the grinding operation completed in one revolution through the machine.

Non-productive machine time is practically eliminated by the automatic feed and work-sizing devices. Each spindle is equipped with a work-sizing unit that actuates the wheel-head feed when the work-pieces approach the high limit of the allowable tolerance. The automatic feed operates in increments as fine as 0.0001 inch. These features automatically compensate for wheel wear, accurately control work quality, and eliminate human errors. When the wheels are worn beyond useful limits, a light signals the operator, the machine stops automatically, and a new wheel is installed. To synchronize the output from the machine with that of the automation equipment with which it is associated, the variable-speed table drive may be provided with remote automatic control.

Fig. 1. Two surfaces on one side of forged connecting-rods are automatically ground at the rate of 1500 per hour on this rotary, five-spindle, surface grinding machine

This rotary automatic surface grinder is capable of producing very fine micro-inch finishes, and accuracy well within commercial limits at extremely high production rates. Each wheel-head is equipped with a 15- to 50-H.P. motor, and is mounted radially on a heavy center column. Stock removal can be as high as 0.150 inch.

For smaller parts requiring a minimum of stock removal, disc grinding permits high accuracy and productivity, plus remarkable adaptability to completely automatic operation. A good example is the Mattison (Hanchett type) double-spindle disc grinder illustrated in Fig. 3, which is equipped with automatic hopper feed. Approximately 0.010 inch of stock is removed from both ends of steel piston-pins on this machine. Production is at the rate of 2100 pieces per hour, and length and squareness of the pins are held within 0.001 inch.

A 30-inch diameter hopper feeds the pins down chute *A* to a stacking mechanism *B*. The pins are picked up automatically and clamped in V-blocks on the rotary carrier plate *C*. The carrier plate rotates between two opposed grinding wheels, and both ends of the pins are simultaneously finish-ground in one pass between the wheels. Finish-ground pins are automatically unloaded through chute *D* into tote boxes. Sizing devices continuously gage the accuracy of the work.

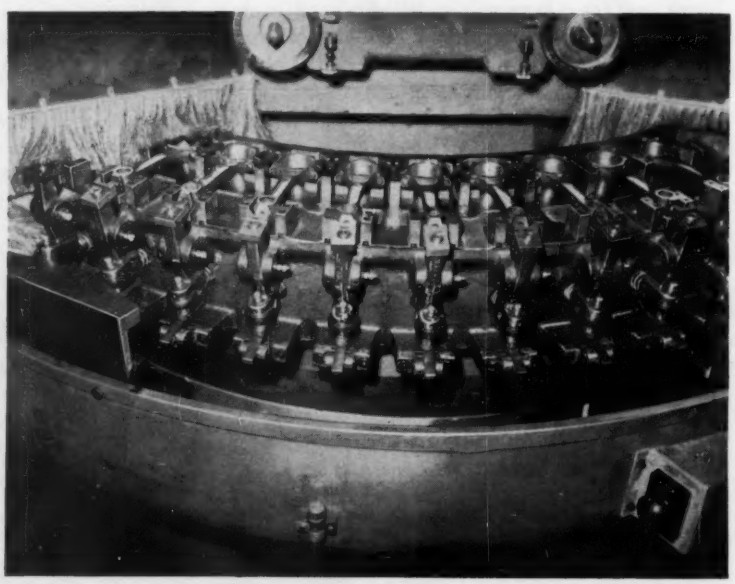
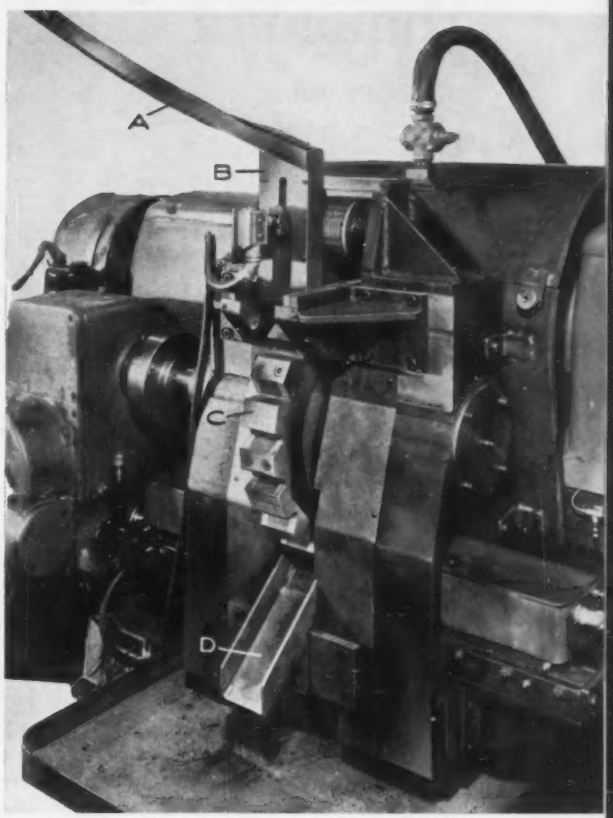


Fig. 2. Work-pieces are automatically clamped and unclamped, in fixtures mounted on the rotary table of the surface grinder, by means of cams

Fig. 3. On this double-spindle disc grinding machine, work-pieces are hopper-fed down chute (A) to a stacking mechanism (B) for automatic loading of rotary carrier plate (C)



When pieces approach the high limit of the tolerance allowed, the automatic feed is actuated to compensate for wheel wear.

Straight-through feed mechanisms offer the highest production possibilities of any feeding method adaptable to double-spindle disc grinders. They are generally applicable to parts having similar opposed surfaces, and where parallelism, flatness, and size must be held to close tolerance. In such set-ups, the parts continue feeding through the machine after passing from the feed mechanism. Automatic clamping and unclamping devices are not required, since the work "floats" between the wheels during the grinding process.

Automatic work-holding fixtures also greatly expand the productivity of vertical spindle, rotary surface grinders such as the one seen in Fig. 4. On this machine 600 large connecting-rods are ground per hour, removing 0.008 inch of stock from both ends of each rod. The rough forgings are finished in one pass per side, with one wheel-head grinding the crank ends of the rods, and the other wheel-head, the pin ends. The step in width between the two ends is held within 0.001 inch. Automatic mechanical clamping and unclamping, and automatic compensation for wheel wear minimize non-productive machine time, reduce skill requirements, and require only spot checking of work-pieces for size.

Standard vertical, rotary surface grinding machines are easily equipped with automatic features. Automatic sizing and wheel feed, plus automatic magnetizing and demagnetizing of the chuck, permit high production and flexibility for grinding a wide range of small, medium, and large size work-pieces.

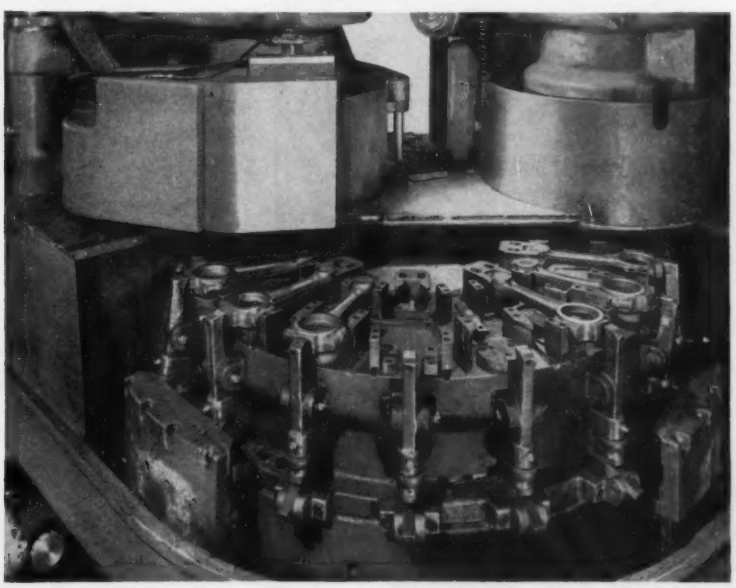


Fig. 4. Approximately 0.008 inch of stock is removed from both ends of each connecting-rod, at the rate of 600 rods per hour, on this rotary surface grinder

Aluminum Can Now Be Flame-Cut

ALUMINUM plate 1/4 inch thick is being flame-cut at a rate of 300 inches per minute in a brand new technique developed by the Linde Air Products Co. Speeds attained in other plate thicknesses are nearly proportional—125 inches per minute in 1/2-inch plate, 75 inches per minute in 3/4-inch plate, and 50 inches per minute in 1-inch plate. The process, termed Heliarc cutting, utilizes a tungsten electrode and an inert-gas shield.

Although non-ferrous metals are relatively soft, they could not heretofore be readily flame-cut. Now, Heliarc cutting these metals offers all the advantages of oxygen-cutting steel—speed, adaptability to mechanical or manual application, adaptability to position and contour, smooth cut surfaces, and high efficiency. An extremely high-temperature, high-velocity constricted arc is employed between the electrode and the work. The concentrated energy of the arc stream melts and ejects a thin section of metal to form a kerf. This jetlike action removes the molten metal mechanically, and the gas atmosphere prevents oxidation of the cut face.

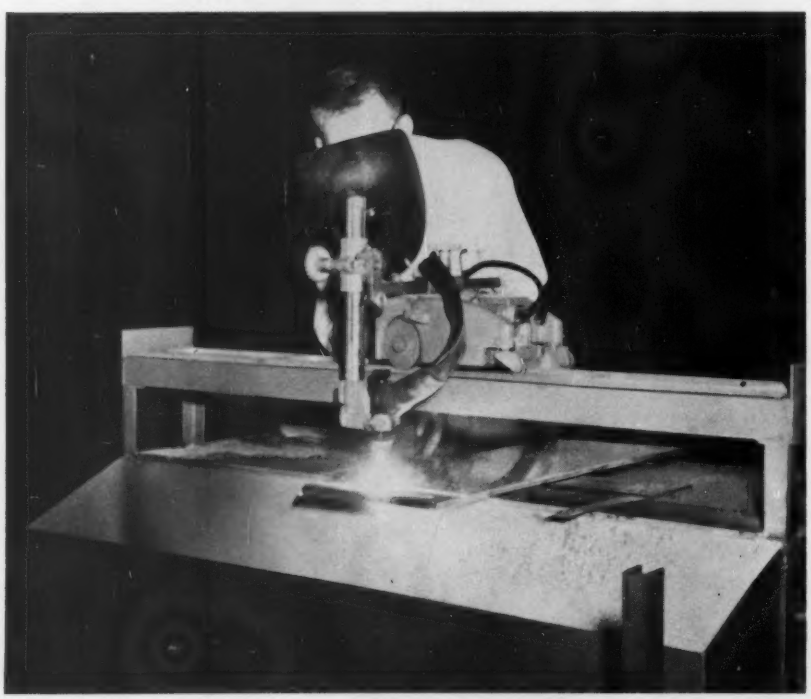
Basic equipment required consists of a cutting torch, control panel, high-frequency unit for starting, electrical contactor, motor-generator set, shielding gas, and water supply and drain. In addition, a travel mechanism is required if the cutting is mechanized. The gas is an argon-hydrogen mixture, in the proportion of 65 to 35 per cent for mechanized cutting, and 80 to 20 per cent for manual cutting. A new collet design for the torch makes for compactness, and places the tubes necessary to water-cool the nozzle inside the torch body.

While Heliarc cutting at present is limited to use on aluminum, continuing research by Linde should soon extend the technique to other non-ferrous metals.

* * *

Large Skin Milling Machine Handles Jet Bomber Panels

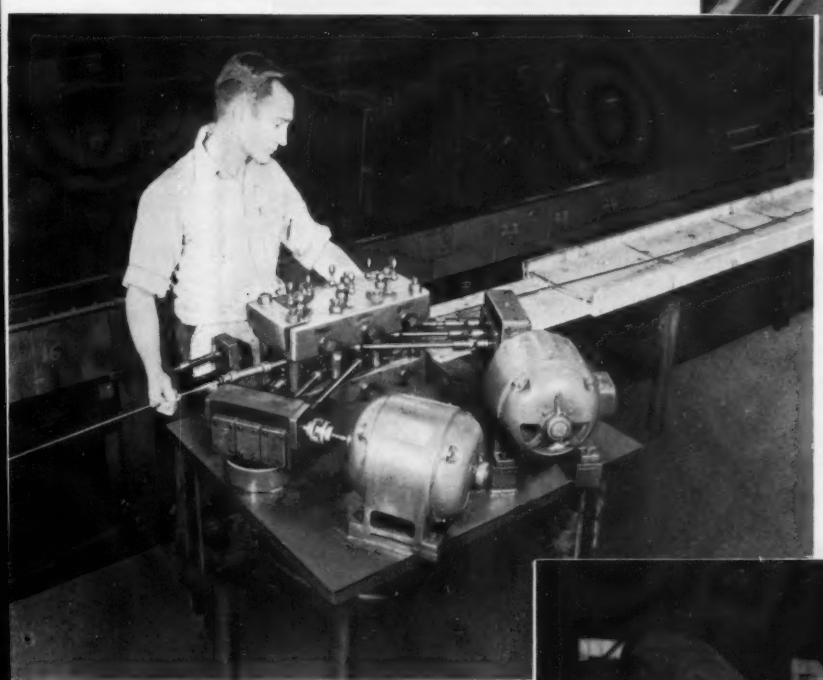
One of the world's largest multiple-head milling machines, incorporating electronic controls, has been built by the Onsrud Machine Works, Inc., Chicago, Ill., for the Boeing Airplane Co., Wichita, Kan. The unit will be used on heavy aluminum plate stock to form the wing skin for the B-52 jet bomber. The machine can accommodate aluminum billets 12 feet wide and up to 50 feet long, can cut three ways simultaneously, and can be operated by only one machinist and a helper. Three cutting heads are capable of plain milling, profiling, and angular cutting.



Aluminum plate is shown being flame-cut as gas-shielded torch traverses the gantry. Cutting in an inert-gas atmosphere until now has been limited to ferrous material.

Versatile Rotary Tube Straightener

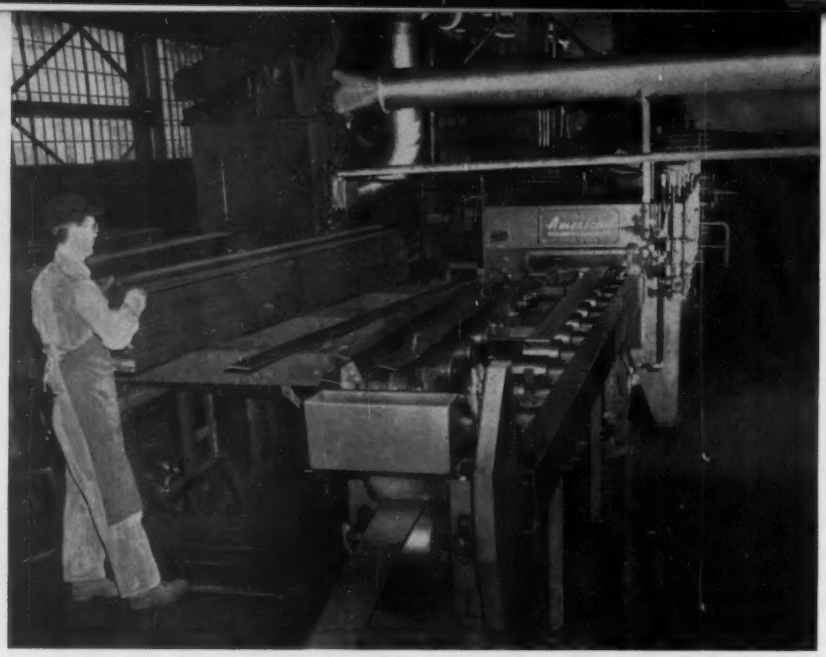
Production practice, backed by engineering research, has demonstrated that a machine primarily designed to straighten metallic tubing can also perform three supplemental plant operations. This straightening machine, manufactured by Mackintosh-Hemphill, Pittsburgh, Pa., has proved effective in straightening round rods of steel, brass, and other metals; light tempering of soft copper tubing; and de-rodding both ferrous and non-ferrous tubing.



(Above) One pass through this rotary straightening machine brings copper tubing from a soft state to about 1/4 hard. This light tempering is done on 20-foot lengths of tubing having a wall thickness of 0.020 inch. At this degree of hardness the copper tubing is protected against accidental damage during handling, yet retains its easy bending quality during later fabrication.

(Left) Successful application of this rotary straightening machine for de-rodding. This is an operation performed to release a sizing mandrel from inside a length of tubing after the tubing has been drawn to size. After slipping the mandrel out of the tubing, the operator will pass the work over to the draw bench which can be seen behind him.

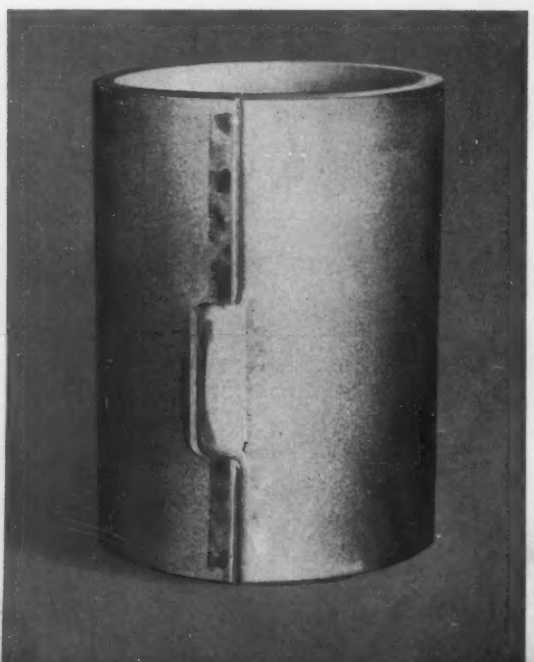
(Right) Removing bends and waves from steel tubing. This model straightening machine handles tubing having an outside diameter ranging from 1/4 to 1 1/4 inches and a wall thickness varying from 0.035 to 0.125 inch, in lengths up to 45 feet. Finished work meets with straightness specifications centering around a deviation of 0.010 inch per foot.



Shot-Blasting Steel Strip Automatically

By GILBERT D. DILL
American Wheelabrator & Equipment Corporation
Mishawaka, Ind.

SPECIAL processing equipment removes mill scale from strips of hot-rolled steel in the plant of a prominent automobile parts supplier. This company has no cutting facilities of its own, so purchases the stock already cut to desired widths. The use of mechanical descalers of standard design was precluded, since such machines are constructed to handle the steel in mill widths.



Two strip materials are being cleaned: S A E 1010, 5/16 inch thick and 6 1/64 inches wide; and S A E 1024, 9/32 inch thick and 5 13/16 inches wide. Strips are 4 to 11 feet long. One of the main uses is for the frames of automobile electric starter-motors. The frame in Fig. 1 has undergone the subsequent operations of blanking, forming, wrapping, and fastening.

The equipment incorporates an interesting two-way conveyor system and turnover station. As can be seen in the heading illustration, the operator lets the strips fall from stacks and slides them, one by one, onto the adjacent conveyor line. Driving rolls advance the strips to the cleaning cabinet. Inside the cabinet, a rubber belt receives the strips, carrying them under a blast of steel-shot abrasive hurled by an overhead blade wheel. Emerging from the other end of the cabinet, the strips travel over another set of rolls into the turnover device, Fig. 2.

Fig. 1. A starter-motor frame that has been shot-blasted, blanked, formed, wrapped, and locked.

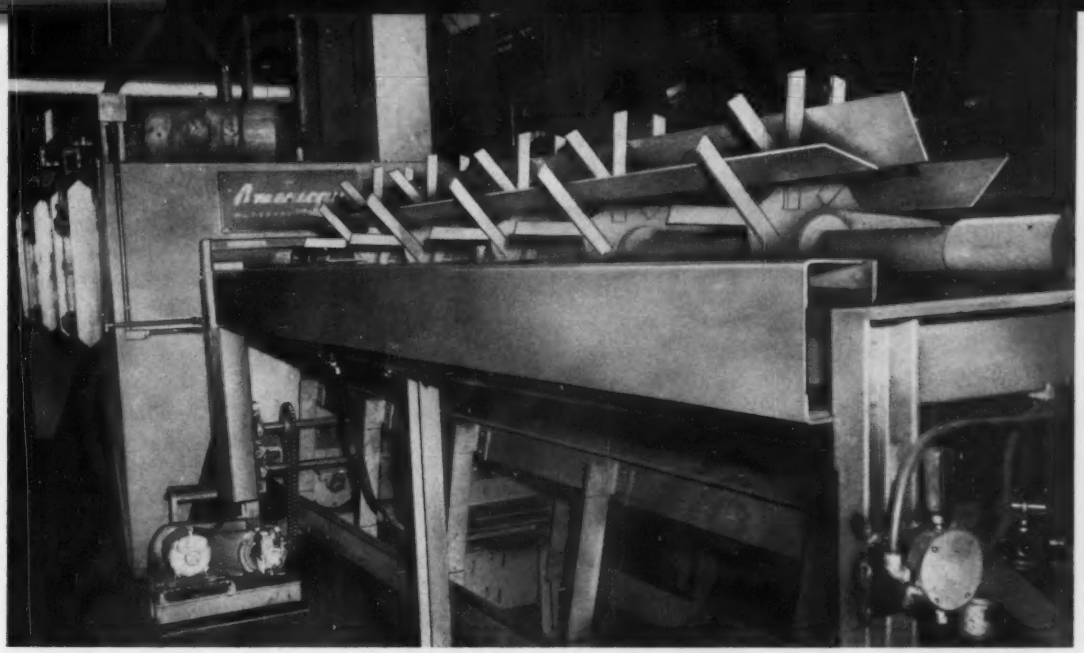


Fig. 2. The fingers of the turnover device rotate between the rolls which drive the work in the opposite direction.

Rotating fingers automatically invert the strips, dropping them onto a second conveyor line. There, the rolls drive the work in an opposite direction, causing it to re-enter the cabinet. Above this line, another overhead blade wheel hurls shot at the second side of the strips. The strips leave the cabinet from the end of original entry, and pass through pinch rolls onto the stacking mechanism, Fig. 3. When a stack of sufficient height has been formed, a chain conveyor carries it away and makes room for another.

Cleaning the strips is continuous, with several in work at the same time. One operator can load the strips and actuate the stacking mechanism. Orderly progression of the strips is controlled by electrical limit switches.

The steel shot used has a nominal particle diameter of 0.017 inch. Design of the cabinet is such that the abrasive can be re-used. After striking the work, the shot falls into a bin. Then it is transported by a screw conveyor and an elevator to a separator. Contaminants are removed, and the good abrasive is returned to the blade wheels.

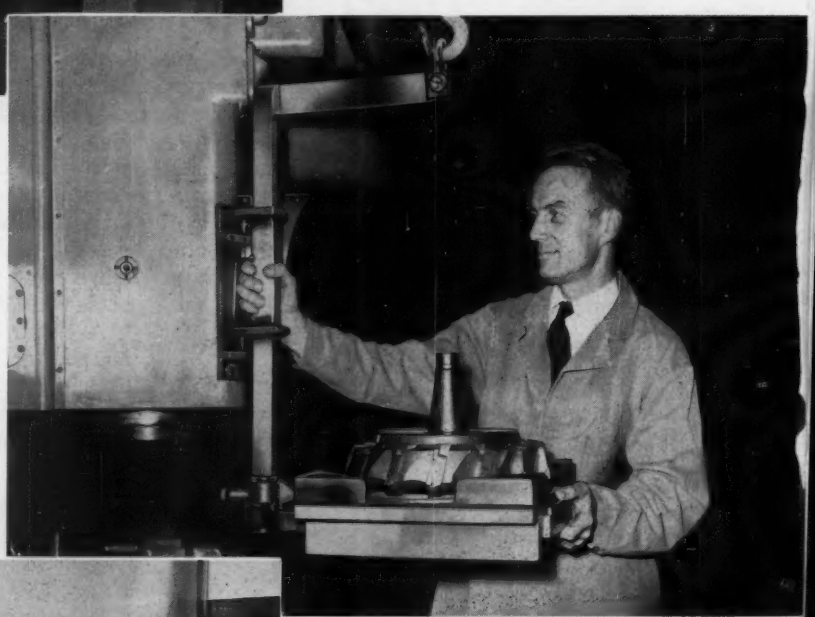
A cleaning rate of almost 7000 pounds per hour is maintained. The machine is capable of cleaning speeds up to 35 feet per minute. It was designed and built by the American Wheelabrator & Equipment Corporation.

Fig. 3. A single operator loads the strips and actuates the stacking mechanism.

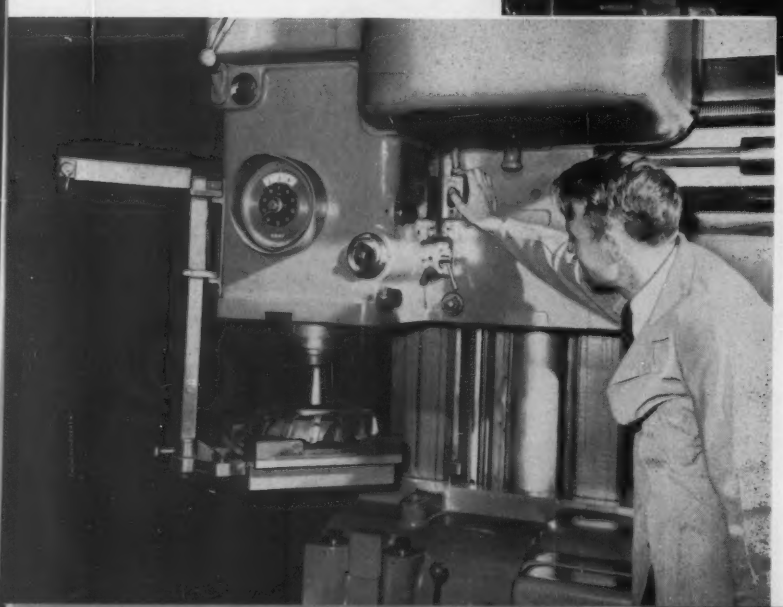
"Sky Hook" Speeds Cutter Set-Up on Milling Machine

A SIMPLE handling device developed by the G. A. Gray Co. for its planer type milling machines makes the set-up and removal of heavy, bulky milling cutters a speedy and safe operation. Called a "sky hook," it is used in conjunction with a small hoist.

(Above) "Sky hook" suspended from a hoist is brought to storage cabinet, located next to the machine, and engages wooden pallet on which face milling cutter rests. A pallet is provided for each cutter employed.



(Left) Button actuating power-operated draw bar is depressed, pulling cutter into spindle nose. "Sky hook" is then swung out of way. Entire operation takes less than one minute. Procedure is reversed for removing cutter.



(Right) After being transported to the milling head, the "sky hook" is lowered until pins on sleeve of vertical member enter hinge-bracket mounted on head. Operator swings hook to align cutter and spindle.

INGENIOUS *Mechanisms*

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Direction-Changing Drive

By FRITZ TWELSIEK, Dusseldorf, West Germany

A large number of machine tool components such as lathe saddles, milling and boring machine tables, and boring machine heads, incorporate movements that lie at right angles to each other. Usually, each of these movements must be independently reversible. It is also frequently necessary to combine these movements in such a way as to obtain four additional movements lying at angles of 45 degrees. A patented, compact direction-changing drive, capable of performing all these functions through the actuation of a single control lever, is presented in the accompanying illustrations.

The outside of the gear-box, from which the gears and control lever have been removed, may be seen at the left in Fig. 1. Relationship of the components to each other, as they appear in the assembled direction-changing drive, is shown in section A-A.

Four gears, *C*, *D*, *E*, and *F*, comprise the train. Two of them, *C* and *F*, are sliding gears and are mounted on the two output shafts *G* and *H*. The remaining two are fixed gears: gear *D* is an intermediate gear and gear *E* is the driving gear, being mounted on input shaft *J*. Both sliding gears are moved by the action of a single control lever *K*, view B-B.

When the control lever is moved at right angles to the center line of sleeve *L*, sliding gear *F* will be shifted by means of arm *M*. This provides positive control over the engagement of the sliding gear with either intermediate gear *D* or driving gear *E*. This may be more clearly seen in the developed section of the gear train, Fig. 2. Movement of the control lever in a direction parallel to the center line of sleeve *L* will cause the shifting of sliding gear *C* through the action of push-pull rod *N* and offset bellcrank *O*. In this way, through the movement of only one control, eight drive motions can be called upon. A ninth, neutral, position is represented by the gear arrangement shown in Fig. 2.

The position of the control lever, together with the positions assumed by the involved gears for each of the eight obtainable output motions, are shown in Fig. 3. In each of these cases input

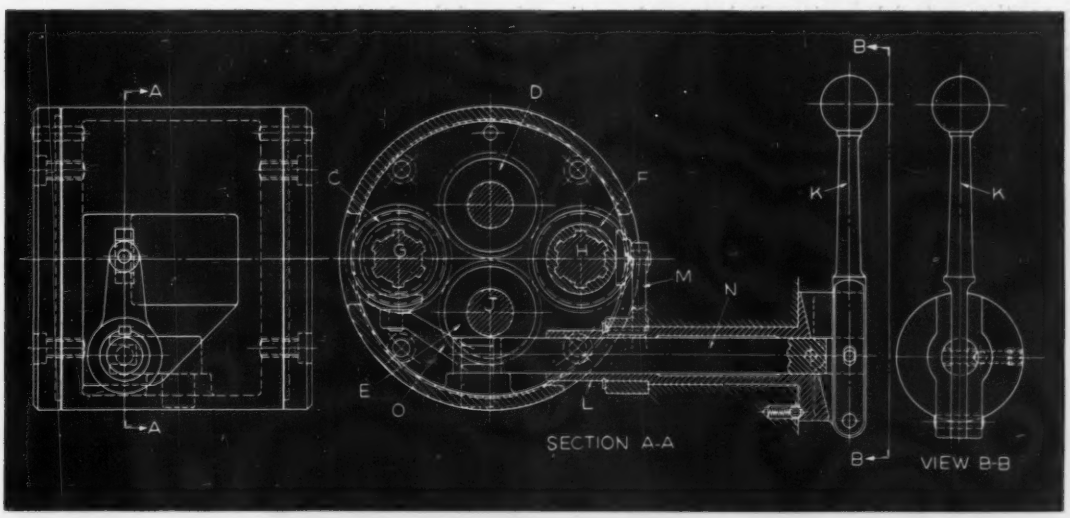
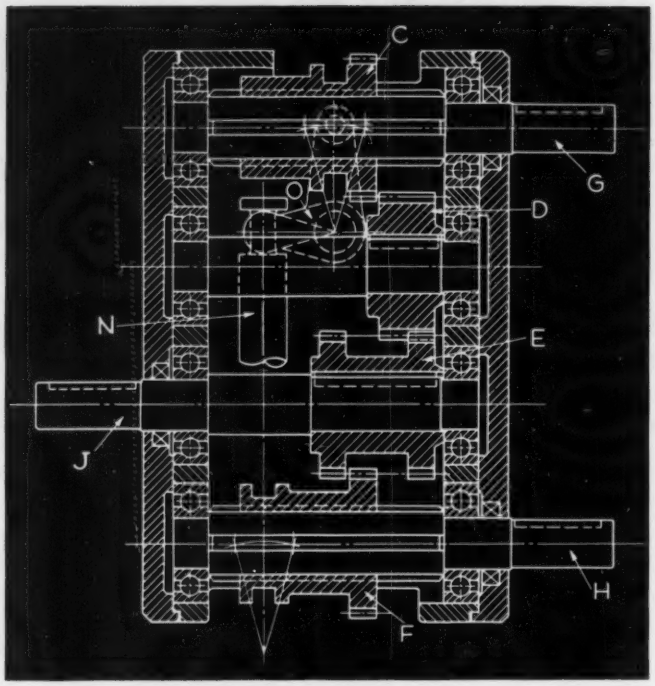


Fig. 1. Compact gear-box provides single-lever selection of eight directional output combinations of shafts (G) and (H) from a unidirectional input shaft (J).

Fig. 2. Developed section of gear train showing types of gears and their position when the control lever is in a neutral position.



shaft *J* is rotating in a counterclockwise direction as viewed from the output side of the unit. When control lever *K* is pulled away from the gear-box, as seen at P, gear *C* is moved to the left into engagement with driving gear *E*. This causes output shaft *G* to rotate in a clockwise direction as indicated by the arrow. It may be noted that intermediate gear *D* and driving gear *E* are engaged at all times.

At Q is shown the condition resulting from pushing the control lever toward the gear-box. Gear *C* is now forced to the right into engagement with gear *D*. The rotation of output shaft *G* is reversed, rotating in the same direction as the input shaft.

To activate output shaft *H* only, the control lever is first returned to neutral. When it is then moved to the left, as at R, sliding gear *F* is engaged with the driving gear and a clockwise rotation is imparted to shaft *H*. Reversal of this motion is accomplished by moving the control lever to the right, thus engaging gear *F* with gear *D*. This arrangement is seen at S.

Four additional sets of movements may be had by combining the basic settings. An example of this is seen at T where both output shafts are being rotated in a clockwise direction. In this case, the control lever is pulled away from the gear-box to engage gear *C* with gear *E*, and then moved to the left so that gear *F* will also be engaged with gear *E*.

To reverse both output shafts to a counterclockwise rotation, as at U, the control lever is pushed toward the gear-box and then moved to the right. This slides both gears *C* and *F* into engagement with gear *D*. The remaining two settings, shown at V and W, illustrate the two additional sets of movements that can be obtained by means of simple two-directional shifting of the single-lever control.

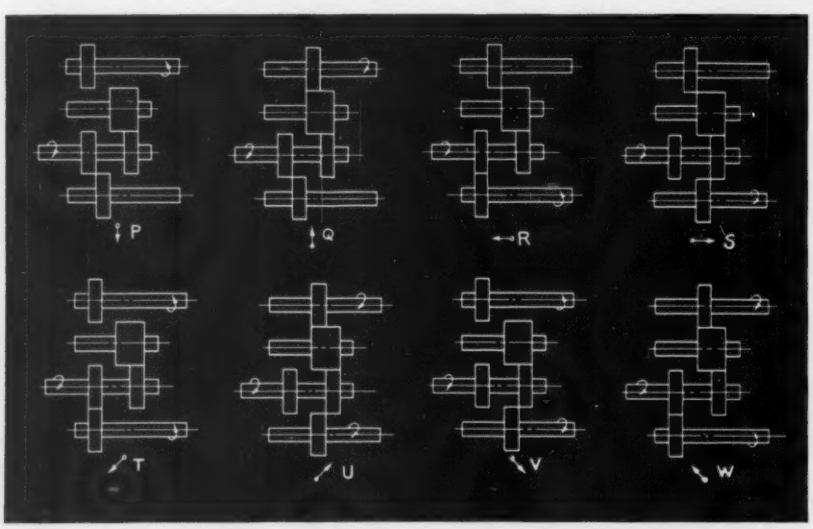
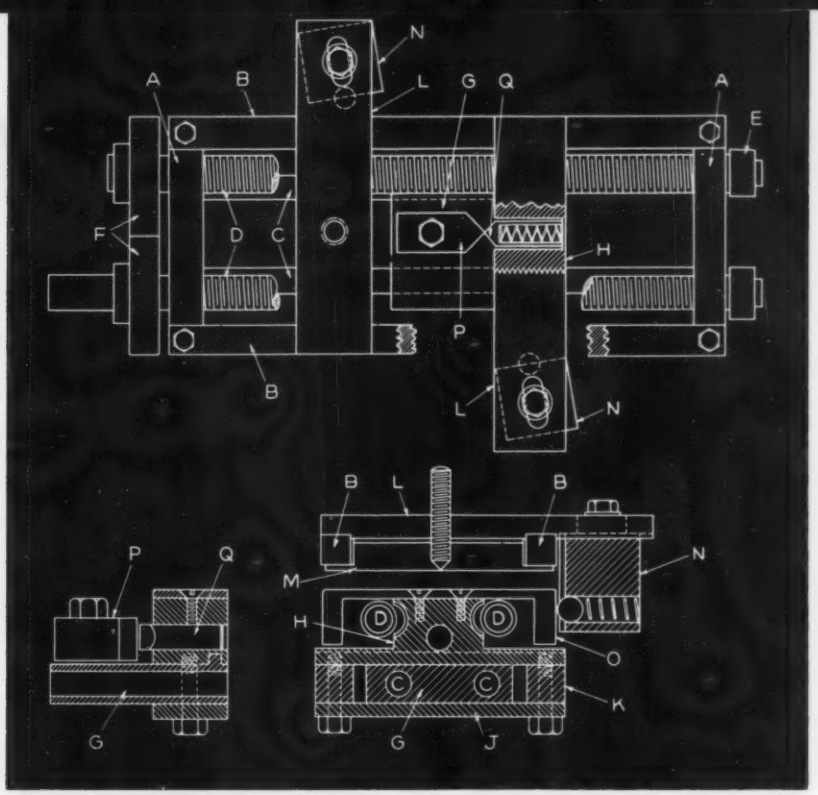


Fig. 3. Diagrammatic representation of the gear and lever positions for each of the eight output variations possible with the direction-changing drive.



Half-nut (H) is disengaged from the lead-screw (D) by the thrust of the trip block (N).

Slide with Automatic Reversal and Adjustable Stroke

By S. P. GOULD, Porterville, Calif.

A half-nut that engages two lead-screws alternately is the heart of a slide mechanism having both automatic-reversal and adjustable-stroke features. Drawings of the principle of the device appear in the accompanying illustration.

The frame consists of two end plates *A*, square bars *B*, and round bars *C*. Both lead-screws *D* are supported in the end plates, being fixed against lengthwise movement by collars *E*. During the operation of the slide mechanism, the lead-screws revolve continuously in opposite directions. The drive for this movement is introduced through the extended left-hand end of one lead-screw and transmitted to the other lead-screw through meshing pinions *F*.

Cross-head *G*, the member required to reciprocate, is a sliding fit on the round bars *C*. The half-nut *H* is splined to the top of the cross-head and is able to move transversely. This half-nut, which has the shape of an inverted T, has two thread sections, one adjacent to each lead-screw.

A keeper plate *J* prevents the half-nut from rising from the cross-head. This plate is joined to the base of the half-nut by cap-screws which run through spacing blocks *K*. Actually, the half-nut never remains in the neutral position illustrated, it being at all times engaged to one lead-screw or the other, as will be explained.

To set the stroke area as well as the length of stroke, two stops *L* are fixed along the frame where desired. These stops straddle the square bars *B*, to which they are clamped by keeper plates *M*. One end of each stop extends over an opposite side of the frame, and supports a trip block *N*. The working face of each trip block is set at an angle of 10 degrees to the center line of the device. In the working face is a spring-loaded ball detent.

To set up its movement from one lead-screw to the other, the nut carries a double-ended shift bar *O*. Each end of the shift bar is also at a 10-degree angle.

In operation, one of the lead-screws moves the half-nut until the shift bar depresses the ball detent in the corresponding trip block, which then thrusts the half-nut out of engagement until it is slightly past a mid-center position over the cross-head. Provision for completing the transverse travel of the half-nut until it engages the other lead-screw is by means of a pointed cam *P* fixed on the cross-head and a pointed spring-loaded latch-pin *Q* projecting centrally from one side of the half-nut. Depressed while the half-nut is disengaging, the latch-pin is released when the half-nut passes its mid-center position, and pushes against the cam to complete the transverse travel of the half-nut. The half-nut then starts its reverse longitudinal movement.

To assure the proper functioning of the mechanism, as well as to simplify construction, the trip-dogs are adjustable in slots in the stops.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Pneumatically Actuated Drill Jig Handles Mating Parts

By A. W. JANSSON, Orrville, Ohio

Mounting holes in the flange of a gear-case and mating cover, used on a mechanical coal stoker, were drilled in individual jigs. After a number of unsatisfactory fits were produced, it became apparent that a more reliable method of locating was advisable. The improved method took the form of a single drill jig capable of being converted to handle both the gear-case and the cover.

As illustrated in Fig. 1, this convertible drill jig is set up to handle the gear-case casting (indicated in phantom lines). Three blocks A_1, A_2, and A_3 not only provide locating surfaces for the casting, but also serve to support it. These blocks are welded to a sliding plate B to form a cradle. Movement takes place between steps machined along both sides of cradle B, and corresponding

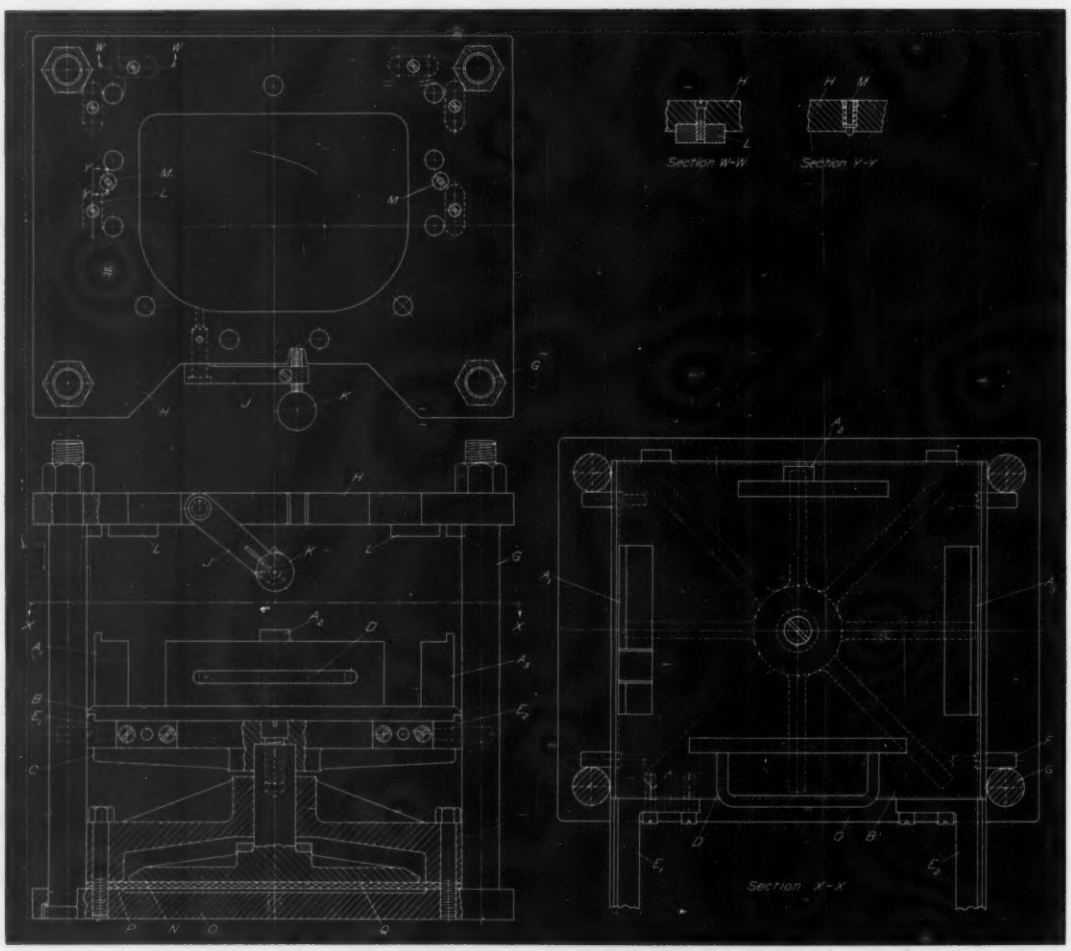


Fig. 1. Drill jig, designed to handle both a gear-case casting and its mating cover, is locked up by air pressure.

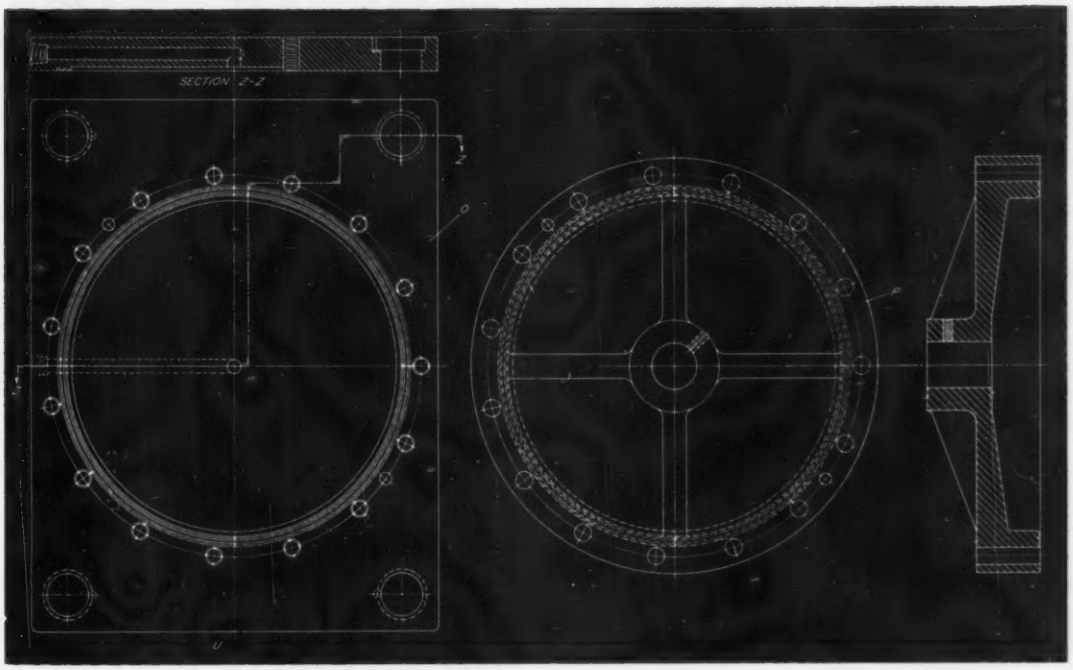


Fig. 2. Machined grooves in both the baseplate at U and the diaphragm cover at V, form an airtight seal with a rubber diaphragm.

rails on platform *C*. Handle *D*, which is supported by a weldment, facilitates operation of the sliding cradle.

Secured to platform *C* by means of cap-screws and dowels, are two extension rails E_1 and E_2. The purpose of these extension members is to permit the sliding cradle to be moved clear of the jig proper, thereby simplifying loading and unloading. Pressed into the sides of the platform are guide pins *F*, which bear against posts *G*.

Supported on the stepped end of the upright posts is stationary bushing plate *H*. A swinging lock-arm *J*, pressed and pinned into the forward end of the bushing plate, carries lock-screw *K*. It is this lock-screw that forces the work-piece against locating blocks A_1, A_2, and A_3.

Fitting within recesses end-milled in the bottom face of the bushing plate are six locating inserts *L*, section W-W. As the work-piece is being clamped, these inserts nest around the periphery, making certain that the bushing plate is properly aligned. If, for any reason, the part is clamped in a cocked position, two indicators *M* will make the situation known to the operator. The rounded end of these plungers normally bear against the work-piece flange if it is properly located. Thus, the top of the plunger should be raised approximately 1/8 inch above the surface of the bushing plate. If either of the two indicators are still flush after the jig has been locked up, drilling should be halted.

A unique feature of this drill jig is the pneumatic locking arrangement employed. Compressed air is introduced beneath rubber diaphragm *N* through a feeder hole drilled in baseplate *O*. This may be seen more clearly at U, Fig 2. The diaphragm is pinched between V-shaped sealing grooves cut in the top surface of the baseplate, and corresponding grooves in the bottom surface of diaphragm cover *P* (V, Fig. 2).

Piston *Q*, Fig. 1, rests on the rubber diaphragm. The rod end of the piston is a sliding fit in a hole bored through the boss of the diaphragm cover. Platform *C* fits over the upper end of the piston-rod and is held to it by a screw.

To use this drill jig, sliding cradle *B* is pulled out and the gear-case casting positioned on the three locating blocks. The cradle is pushed back until it contacts two machined lugs at the rear of, and integral with, platform *C*. Lock-arm *J* is then swung down and lock-screw *K* advanced to assure positive seating of the casting against the locating blocks. An air valve (not shown) is actuated, pressurizing the area between diaphragm *N* and baseplate *O*, and causing the diaphragm to flex upward. Piston *Q* is forced to rise, carrying with it platform *C*, cradle *B*, and the work-piece.

When the upper surface of the casting to be drilled has been nested between locating inserts *L*, and is in solid contact with the underside of bushing plate *H*, both plungers in indicators *M*

will rise. This signifies proper seating of the work, and the fact that drilling may begin.

Although the drill jig, as illustrated, is set up for handling the gear-case only, provisions have been made to handle the mating gear covers. This conversion entails changing one component and adding another. Bushing plate *H* is replaced by a second plate having appropriate bushings for the cover casting. An auxiliary cradle for locating the cover, designed for attachment to sliding cradle *B*, is added to the jig.

Two-Stage Bending Die for Hose Clips

By Federico Strasser, Santiago, Chile

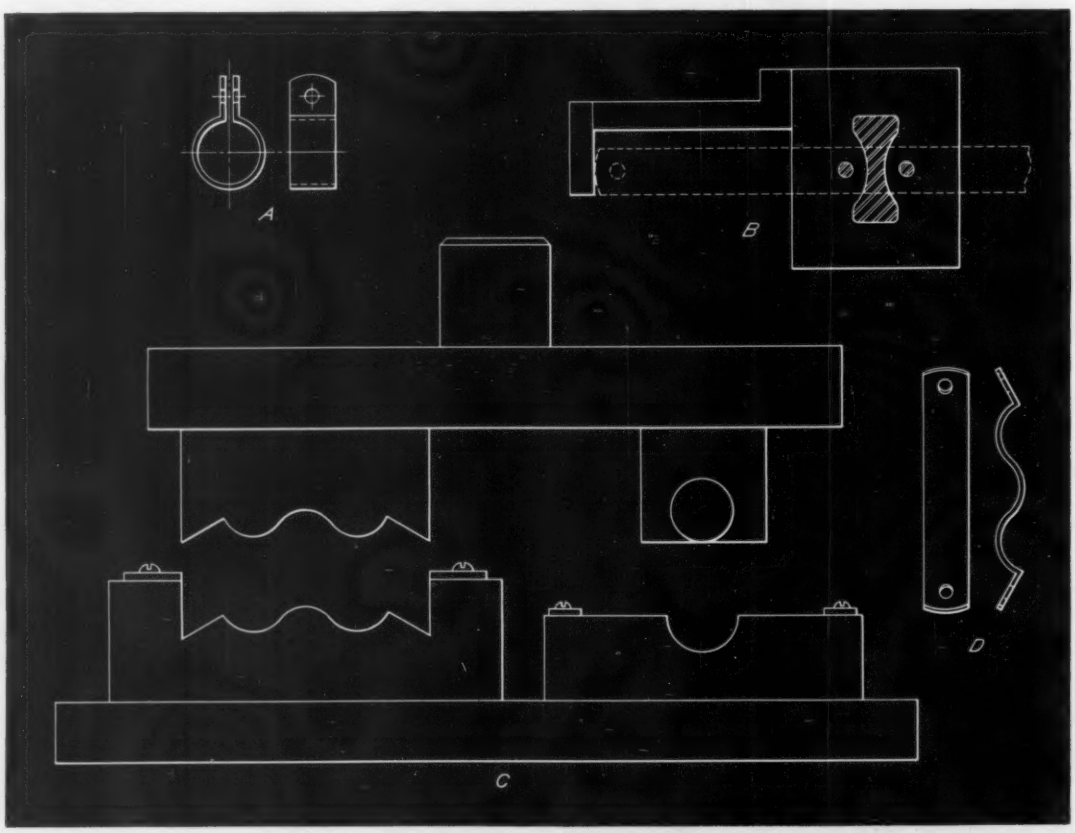
The simple hose clip, view *A* in the accompanying illustration, is cut off and pierced from coiled strip, then completely formed in a two-stage bending die. In view *B* is shown the lay-out for the cutting off and piercing operation. With the strip advanced against a stop, the adjoining ends of each two clips are rounded and pierced in a single stroke of the press.

In the bending die, view *C*, the first stage produces the shape shown in view *D*. The second stage reverses the center of the part, blending it with the adjacent radii to form the circular shape of the completed clip. Both stages of the bending die are operative at the same time, a part from the first stage being loaded directly into the second stage.

• • •

Sets for Metal-Cutting Band-Saw Blades

Three different styles of set are commonly used for metal-cutting band-saw blades. Blades with teeth set alternately right and left are similar to wood-cutting blades. This style can be used for cutting all the softer metals. Regular set blades have one unset raker tooth to each pair of set teeth, the raker serving to keep the cut clean. This style of set is used for cast-iron, steel, Monel metal, etc. The wavy set blade has teeth in groups, one group forming a wave to the right, the other to the left. It is used extensively for thin material and tubing. A good selection for general use should include blades having 14, 18, and 24 teeth per inch.



The clip is completed by a combination piercing and cut-off die and a two-stage bending die.

Ideas for Shop and Drafting-Room

Tailstock Plug Replaces Toolmakers Button

By Frank E. Chace, Pawtucket, R. I.

Although the use of buttons for locating work on the faceplate of a lathe still remains popular with toolmakers, the time required to set them up is a distinct disadvantage. A time-saving substitute for the button method makes use of a tapered plug that replaces the tailstock center. This method is shown diagrammatically in the accompanying illustration.

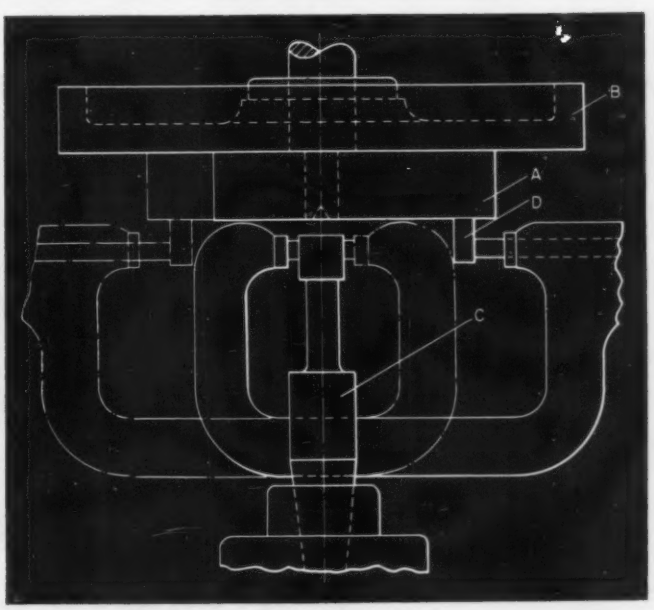
The hole to be bored is first center-punched or spot-drilled after which the work-piece *A* is mounted on faceplate *B*. In mounting, the punch mark is approximately centered by eye. The tailstock is then moved up until the ground end of tapered plug *C* is close to the work.

Assuming that the tailstock is located on-center, it is merely necessary to measure the distance, in a horizontal plane, from the button end of the plug to a key or reference point *D* on the work. This is shown in solid lines in the illustration. From this reading must be subtracted half the button diameter. If the desired hole location on the work-piece is in alignment with the headstock spindle in this plane, the resulting figure will correspond to the appropriate locating dimension on the blueprint. If the readings don't correspond, the work should be shifted slightly and the measurement retaken. By rotating the faceplate to bring a second reference point into the horizontal plane, then following the same procedure, location of the hole to be bored can be accurately accomplished.

In some instances the tailstock may not be in line with the headstock, such as in cases where the lathe was previously used for offset-tailstock taper turning. It is not necessary to align the tailstock if the following procedure is used.

To accurately determine the distance from reference point *D* to the center of the headstock spindle, a measurement is taken from the button end of the plug to the reference point on the work. When doing this the button and the reference point must be in a horizontal line as closely as the eye can judge. After recording this reading the faceplate is rotated 180 degrees and a second measurement taken from the same reference point as shown by broken lines in the illustration. The two readings will differ. Subtract the radius of the button from both figures and then average them, the resultant measurement being the correct distance from the reference point to the headstock center.

This distance will more than likely differ slightly from the specified figure on the blueprint as the work-piece has only been located by eye. An adjustment of the part, followed by a second set of readings using the same reference points, will permit centering of the hole location in this plane. By repeating this procedure with a second reference point, after bringing it into a horizontal plane also, final centering of the hole to be bored can be obtained. Although this method is not as accurate as using toolmakers buttons, it is suitable for all but the most precise work.

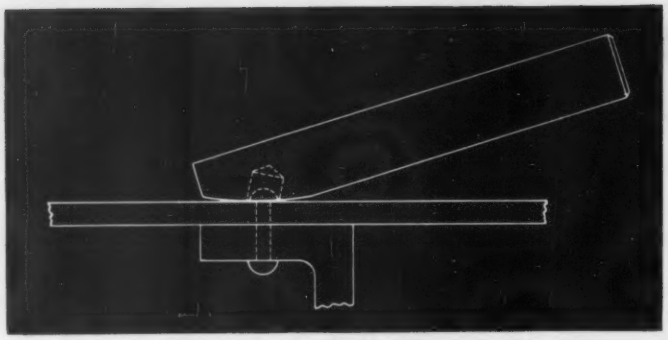


A plug, with a shank tapered to fit the tailstock sleeve, is used to replace the conventional toolmakers button.

Rivet-Head Chisel

By Clifford Molloy, New York, N. Y.

The disassembly of riveted sections in a machinery rebuilding shop is speeded with the chisel illustrated. Many rivets must be removed, and cutting the heads off proves quicker and less



A chisel design that makes the cutting off of rivet heads a quick and safe operation.

damaging to the holes than drilling them out. However, a plain cold chisel permits the heads to fly off, creating a danger to the worker.

The tool is a piece of chisel steel, cut as shown, with a hole drilled at an angle, and hardened. When the heads are cut off, they remain in the hole, which is made slightly larger in diameter than the heads. The cutting face is readily sharpened and can be either flat, or slightly curved.

Pendulum Indicates Centering of Lathe Tool

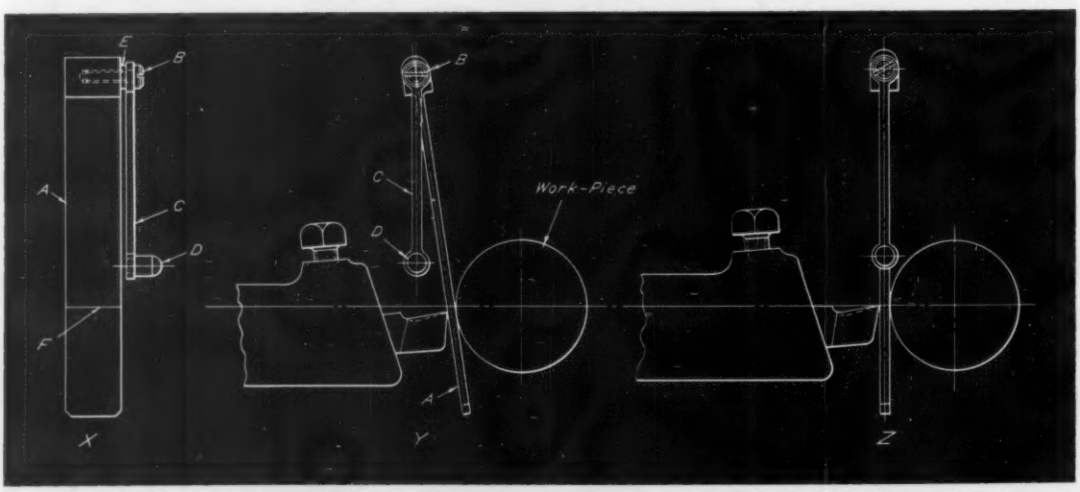
By W. M. Halliday, Southport, England

An alternative to the method of setting a lathe tool at the spindle center line described by Stanley P. Gould, page 207 in the September, 1954, issue of MACHINERY, is here presented. Being slightly more elaborate, this method utilizes a pendulum type device.

Body *A* of the illustrated unit is made of steel and is hardened to resist marring. It is machined to a thickness of approximately 1/8-inch along the major portion of its length, having a head 3/8-inch thick at the upper end. This head is drilled and tapped in line with the body to receive shoulder-screw *B*.

Pendulum *C* is mounted on the shoulder of screw *B*. A 1/4-inch diameter stepped-pin *D*, which serves as a weight, is pressed into a hole drilled through the lower end of the pendulum. The width of the pendulum should be exactly the same as the width of the body so that the two components will line up when the device is held vertically. A washer *E*, about 1/16-inch thick, provides the clearance necessary to prevent the units from contacting each other. To ensure that the device will be set square to the work-piece in a longitudinal plane, a light line *F*, as shown at X in the illustration, is scribed for locating the cutting edge of the tool bit.

When the tool bit is positioned below the work-piece center line, the pendulum unit will cant as shown at Y. When the cutting edge is centrally located, the pendulum and the body will line up as may be seen at Z.



Pendulum type device is pinched between lathe tool and work-piece to indicate positioning of cutting edge on lathe spindle center line.

Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Training Sales Engineers To Sell Quality

A BIG problem in developing business is to train each sales engineer to sell quality rather than price. Price is expressed in currency digits. Quality means value now and over years to come in terms of customer interests. Price is recognized right off. Values lie dormant and hidden. They must be made real.

Buying consists of weighing known values against price. Selling consists of establishing pertinent values to outweigh price. Selling is wasted unless it adds weight to value.

With this viewpoint, what steps must be taken to achieve quality selling?

1. Identify all quality features that apply to each equipment item and stress the supplier's ability to serve the buyer.

2. Evaluate quality features and select those appropriate to the sales problem at hand.

3. Present each quality feature in a convincing way.

Let us itemize the chief points that comprise the three steps named to the end that every salesman may sell quality rather than price.

1. **Identifying Quality Features**

Applying to the equipment sold:

- Designed for a given purpose.
- Materials used in fabrication.
- Functional operations.
- Continuity or life.
- Ease of installation or maintenance.

Applying to the supplier:

- Application engineering service.
- Maintenance helps.

2. **Evaluating Quality Features**

Obviously purchasers who buy for dollar results have varying interests. Some features or services are paramount, others of minor importance. The industry, the application and the whims of the buyer determine selling points to select to attain favorable decisions.

Continuity of operation may exceed all other advantages in mass production plants. A ten minute shut down may equal the total price of one machine! Flexibility in equipment may be of greatest importance to the small plant. Maintenance services may stand out when the purchaser does not have his own servicing facilities.

Classify prospects as to their particular interests, when shaping the selling effort.

3. **Presenting Quality Features**

Selling quality extends far beyond the actions of the individual salesman. It can be implemented through:

- Advertising.
- Selling Literature.
- Technical data.
- Displays.
- Selling tools, such as samples and sales kits.
- Examples of satisfied users.

All these avenues are open for the selling of quality, and can be properly tailored to match customer interests. When it comes to training the individual salesmen in quality selling, much remains to be done. There is often a distinct lack of orderly procedure by the sales manager and likewise of vivid presentation by the salesmen.

One sales manager has approached the matter of quality selling in a very intelligent way. His sales manual goes far beyond equipment description and matters of ordinary selling procedure. He lists not only every quality advantage, but identifies advantages that apply to distinctive industries and individual applications. It outlines best methods of presentation and is supported by a kit of selling tools that includes samples and in some instances, models. It is replete with key examples—based on past sales—of effective arguments to support quality.

They do not have quality factors interpreted into results staring at them like a chart on the wall when they talk to a customer. They do not select quality items to match the individual interests of the prospect. They shudder when confronted by a lower price and fail to accept "your price is high" as a challenge rather than an unfounded objection. They assume a defense rather than an offense. They are lost in framing their sales arguments convincingly.

The equipment sales manager should adopt a comprehensive program for training sales engineers in quality selling and provide them with adequate tools with which to work.

LATEST DEVELOPMENTS IN *Shop*

Jones & Lamson Optical Contour-Grinding Machine and a High-Production Tap Grinder

The contour-grinding machine, Fig. 1, and the tap grinder, Fig. 2, are newly developed products of the Jones & Lamson Machine Co., Springfield, Vt. The contour-grinding machine is made up of two basic elements. One element is a special surface grinder equipped with hydraulic tracer control and the other is an optical comparator with a screen 30 inches in diameter arranged for visual and manual control of the grinding wheel from a contour chart.

An outline chart showing the enlarged contour of the desired work-piece is mounted on the comparator screen. An equally enlarged image, representing the cross-section form of the cutting edge of the grinding wheel is projected on the screen. As the position of the grinding wheel is changed with respect to the work-table, the projected image moves in the same direction and a distance proportional to the enlarged image.

The image is the projection of an auxiliary stylus located in the focal plane of the lens system. The cross-section of the stylus is identical with that of the edge of the grinding wheel. Since the stylus is mounted on the same member as the grinding wheel, its movement is directly derived from that of the grinding wheel. Convenient controls permit the operator to advance the grinding wheel along a given work contour. The projected image, representing the cutting edge of the wheel, is simply made to follow the outline chart mounted on the comparator screen. The grinding wheel can also be template-controlled by a master stylus and hydraulic tracer. Work first produced by manual and comparator control can in turn be reproduced in quantity by automatic tracer control.

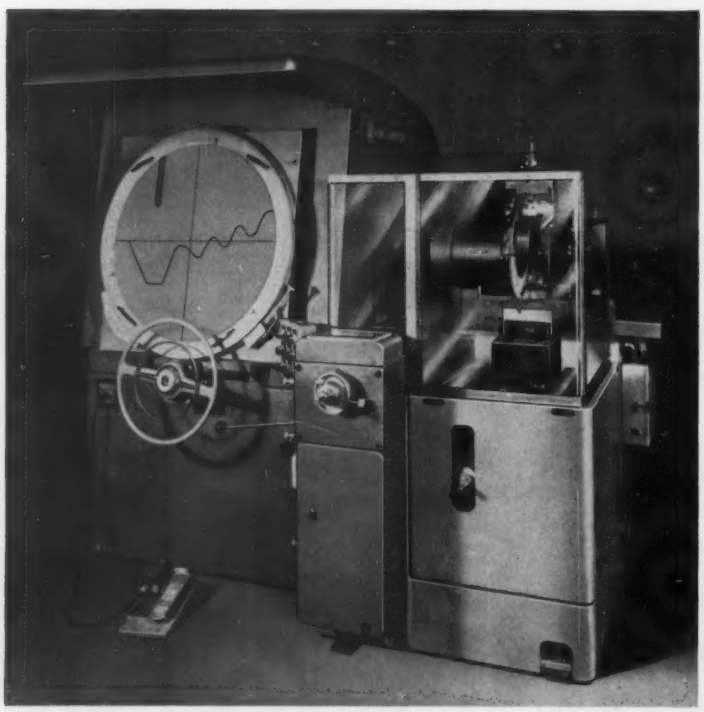


Fig. 1. Jones & Lamson contour-grinding machine with hydraulic tracer and optical screen comparator

The optical comparator has three precision lens systems with 5×, 10×, and 20× magnifications having field diameters of 6, 3, and 1 1/2 inches, respectively. The outline chart showing the desired profile of the work-piece is mounted on the comparator screen. This chart is enlarged to the same scale as the magnification of the lens system. The equally enlarged image representing the cross-section form of the dressed cutting edge of the grinding wheel is projected on the screen from the auxiliary stylus mounted on a bar extending into the lens system focal plane from the grinding-wheel rocker arm. Since this stylus never leaves the focal plane, its projected image always remains brilliant, in sharp focus, and in the same erect position. Its direction of travel is also the same as that of the grinding wheel. Two focal plane styluses about 6 inches apart make it possible to grind contours in excess of approxi-

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

mately 6 inches and under 12 inches in length while using a 6-inch diameter lens system.

The work-table oscillates from front to back, the length and rate of travel being adjustable. The table surface is in a horizontal plane and can be elevated or lowered by a hand crank to graduated dial readings of 0.0005 inch. The carriage of the grinding wheel is mounted on anti-friction rollers and is located above and to the rear of the work-table. Its movement provides lateral wheel feed across the work-table.

The grinding wheel is located in a vertical plane, above and in line with the table travel. It is mounted on the forward end of a horizontal rocker arm, the latter being trunnion-mounted at its mid point on the wheel carriage. The center lines of the wheel spindle and trunnion mount are parallel, enabling the wheel height to be controlled by simply tilting the rocker arm up and down. This control is provided by a hydraulic tracer mounted on the rear end of the rocker arm. Vertical stylus displacement tilts the rocker arm, moving the wheel an equal amount. (The movements of the lever arms of the wheel spindle and the point of the tracer stylus about the trunnion center line are equal and lie in the same plane.)

The hydraulic tracer control is used while generating from a chart and projected image, as well as when reproducing a finished part by mechanical feed and tracer control. For direct reproduction, the finished part serves as a fixed template for guiding the tracer stylus as the grinding wheel carriage advances under mechanical feed. Contours up to approximately 30 degrees from the vertical can be reproduced in this manner. When generating from a chart and projected image, the stylus displacement is manually controlled and can be used to grind contours up to the vertical. Coolant may be used on the grinding wheel since the comparator projection system is fully protected and removed from the grinding area.

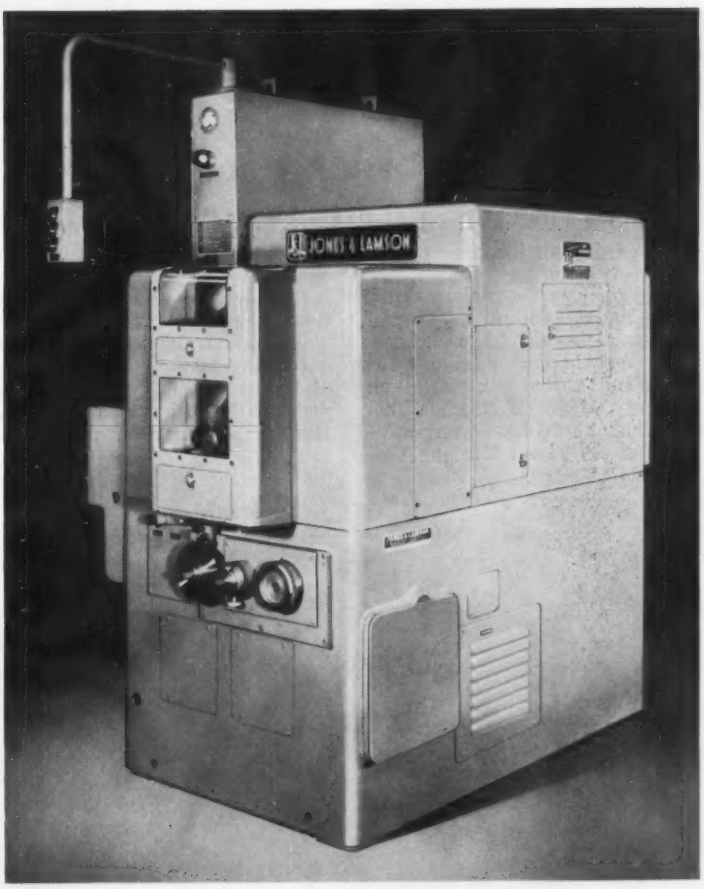


Fig. 2. High-production tap grinder introduced by Jones & Lamson Machine Co.

Simplified controls facilitate grinding from a chart. Automatic lateral wheel feed and single-cycle work-table control can be used when desired. A manual control wheel, conveniently mounted in front of the comparator, is used for vertical adjustment of the grinding wheel. Here the tracer control stylus is displaced by a flat template mounted on a vertical slide linked to the control wheel.

The grinding wheel carriage feed in the lateral direction with respect to the work-table is mechanical. It has the same main

drive and electric clutch and brake control as the reciprocating work-table. Automatic ratchet feed of the grinding wheel in either direction is adjustable down to increments of 0.001 inch per stroke of the work-table. Three hand levers controlling the dog-tooth clutches provide the following lateral wheel feed controls: automatic ratchet feed at one extremity only of the table travel; automatic ratchet feed at both extremities of the table travel; manual ratchet feed for more critical feed control; and adjustable and continuous feed without table reciprocation.

The tap grinder, Fig. 2, is equipped for automatic work handling. This machine is specifically designed for high-production grinding of standard taps. A wide range of work speeds is available for effective grinding of taps of all sizes from 0 to 5/8 inch in diameter. Individual lead-screws for each pitch have one-third the pitch of the thread being ground, thus insuring long lead-screw life.

Grinding cycles are held constant and uniform as rapid wheel advance, depth of cut, and rapid withdrawal are positively controlled through a simple cam action. Wheel-truing is automatic before or after a finish cut and is counter-controlled when more than one piece is ground per dressing. Wheels 20, 18, or 16 inches in diameter are used. The work- and wheel-slides are mounted on anti-friction bearings. The wheel-slide is held against a positive stop with uniform hydraulic pressure for automatic, positive size control. Multiple cuts can be taken.

Circle Item 101 on postcard, page 239

Morris Radial Drill, Drill Unit, Balancing Machine, and High-Speed Production Machine

"Hydra-Power" radial drills, "Cam-Matic" drill units, a piston-balancing machine, and a high-speed production machine for processing carburetor parts—all built by the Morris Machine Tool Co., Cincinnati, Ohio—were introduced at the recent Machine Tool Show in Chicago.

Push-buttons replace conventional levers and handwheels to make radial drilling operations easier and faster in the new line of 13- and 15-inch column radial drills of the design seen in Fig. 1. Merely pushing a button will raise or lower the arm; traverse the head left or right; clamp or unclamp the arm, head, or column; and even shift the gears of this machine. All push-buttons are located in a single panel, positioned at the operator's right. A completely integrated electro-hydraulic control system enables this single nerve center of the machine to supervise the operation of all its components. It is possible to select the spindle speed and feed for the next operation while the current operation is being performed. The operator simply dials the new speed and feed. Then, when the current operation is completed, he merely pushes a button and the new speed and feed combination is automatically selected by the hydraulic device.

Other features of the new radial drills include: an automatic tool ejector; built-in electric light; thirty-six spindle speeds in either of four ranges; and eighteen feeds including changes for cutting 8, 11 1/2, 14, 18 and 27 threads per inch.

Automatic operations and variable thrust to suit the material being machined are the outstanding features of a new line of Morris cam-fed drilling units. Drilling, tapping, and allied operations, with automatically controlled operational cycles, are performed with these Cam-Matic drill units of the type shown in Fig. 2.

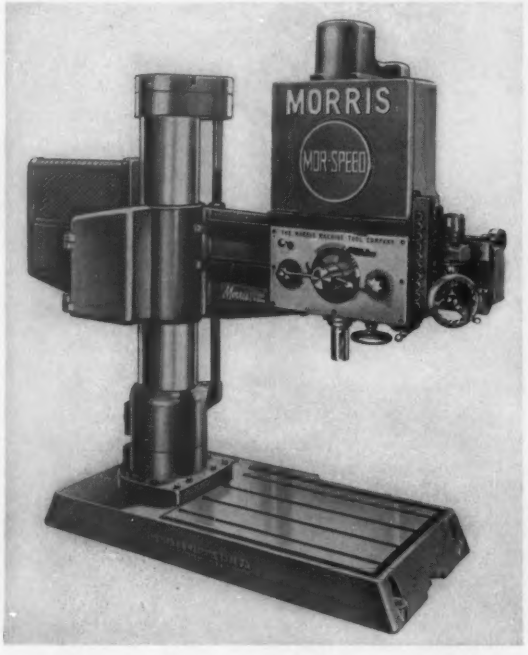


Fig. 1. "Hydra-Power" radial drill recently introduced by the Morris Machine Tool Co.

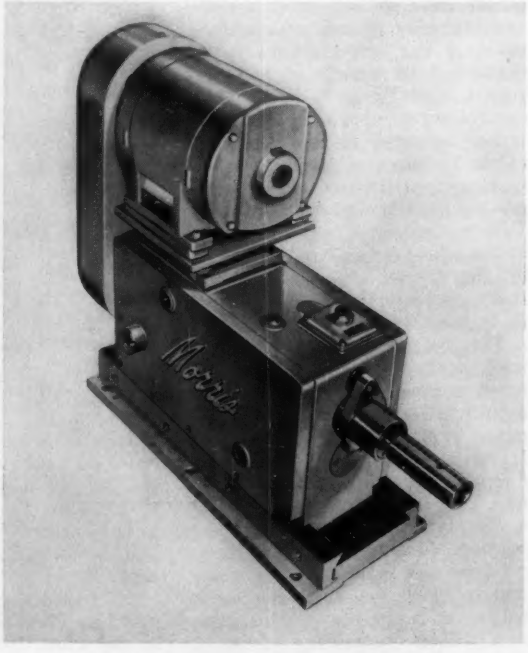


Fig. 2. Morris "Cam-Matic" cam-fed drilling unit equipped with electric clutch

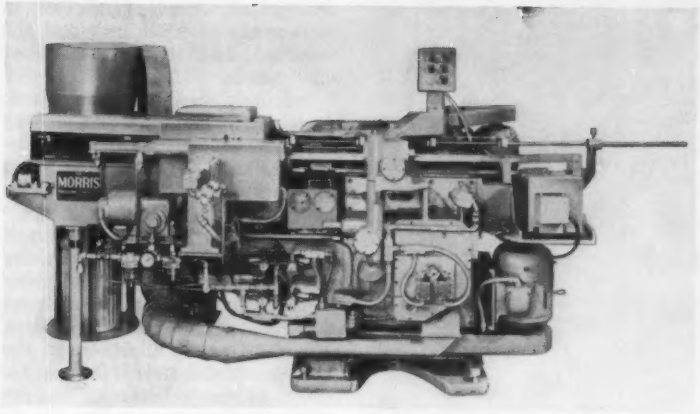


Fig. 3. Automatic piston-balancing machine brought out by the Morris Machine Tool Co.

These units employ an electric clutch in place of conventional linkages and power transmission devices, making them more compact. The amount of thrust required for a particular job may be selected with the rheostat dial. Should the drill unit encounter an obstruction, the electric clutch will slip, preventing damage to the unit and to the work-piece.

Additional features include extra rigid quill construction; protection to prevent surging on breakthrough; maximum bearing-to-stroke ratio for extreme accuracy; three drive arrangements; two model sizes for drilling holes up to 1 1/8 inches in diameter, with a stroke of 6 inches. A completely separate compartment for changing pick-off gears, separate electrical section, sliding base for easy set-ups, wide range of spindle speeds and a self-contained automatic lubrication system are also features of the drill units.

The new piston-balancing machine, Fig. 3, offering complete automation and extreme accuracy is another recent development of the Morris Machine Tool Co. This unit automatically receives, weighs, sorts, positions, clamps, machines, and discharges internal combustion engine pistons at production rates up to 720 pieces per hour. It maintains piston weights uniformly to tolerances of plus or minus 1 gram. The machine receives pistons by conveyor and automatically tests each one for proper machining position, rejecting pistons received in the inverted position. The balancing machine is driven by a heavy-duty 5-H.P. motor; is equipped with a complete electronic cycle control panel; and has an automatic positive lubrication system.

Carburetor air horns are machined at the rate of 375 per hour by the new high-speed production machine, Model 309-S shown in Fig. 4. This machine drills, burrs, reams, taps, and spot-faces, performing twenty-four operations on twenty-one holes on four perpendicular and one angular face. It can be easily adapted for almost any type of mass production work requiring multiple drilling operations. Unit Type construction permits fast, easy realignment of the machine for product model changes, for completely new models, or for other types of products.

The hydraulically operated indexing table is mounted on the central column. The indexing table is fitted with air-powered clamping fixtures to hold the products. The table indexes through twelve operation stations, where the fixtures are automatically indexed and positioned by cams on the central column. The machine operator merely loads unfinished pieces and unloads completed parts.

Circle Item 102 on postcard, page 239

"Shear-Weld-Trimmer"

A 56-inch automatic strip splicer, "Shear-Weld-Trimmer," integral combination machine for butt-welding coil stock 0.010 to 0.250 inch thick in continuous strip lines was introduced at the Machine Tool Show by the Morton Co., Muskegon Heights, Mich.

Circle Item 103 on postcard, page 239

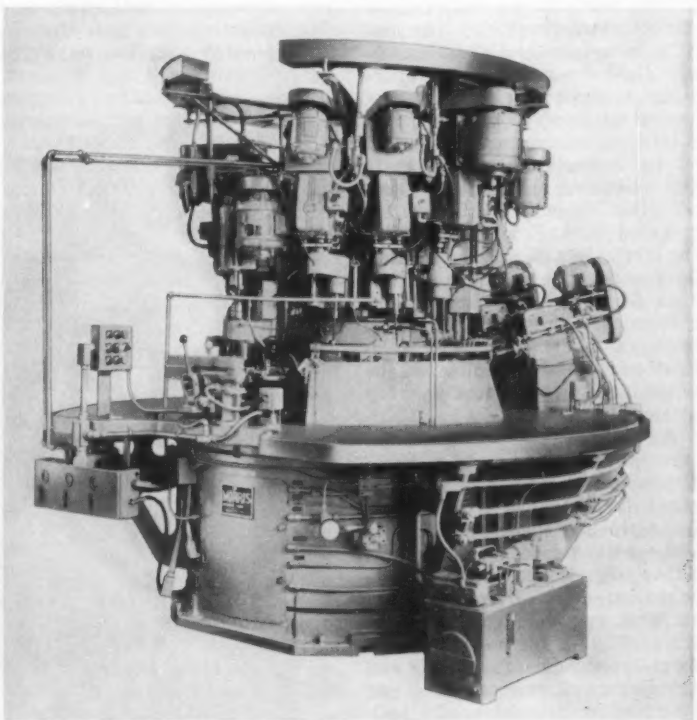


Fig. 4. Morris special high-speed production machine for processing parts requiring multiple drilling operations.

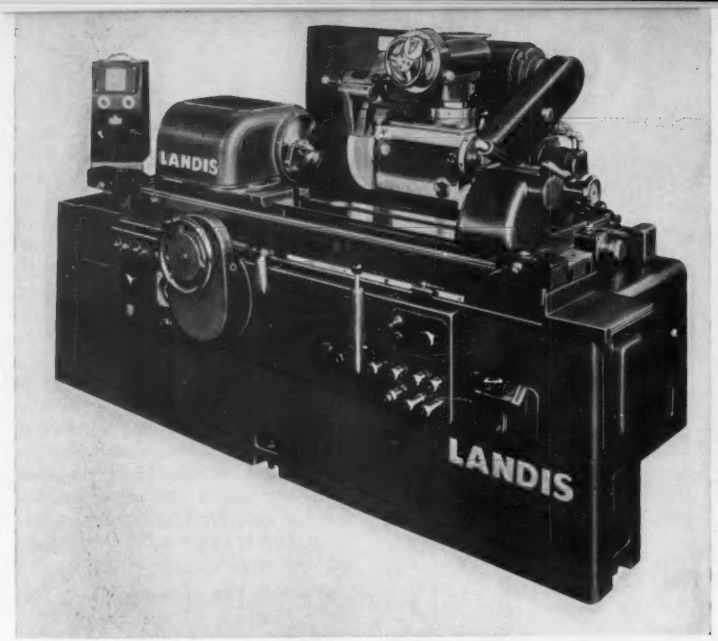


Fig. 1. Landis universal cylindrical grinder

Landis Universal and Plain Cylindrical Grinders

The universal cylindrical grinder illustrated in Fig. 1 was introduced by the Landis Tool Co., Waynesboro, Pa., at the recent Machine Tool Show in Chicago. This 12- by 36-inch, Type K universal cylindrical grinder incorporates many advanced features and its new contour design gives it a pleasing appearance. The machine is compact and of exceptionally rigid construction. All operating controls are conveniently located on front of machine.

Hydraulic valves are so mounted as to lessen maintenance costs and eliminate excessive heating of the machine. Separately mounted tanks are provided for the lubricating oil and the hydraulic system. Separate pumps are used for the hydraulic pressure system and for lubrication of the bedways. The coolant tank is located to facilitate cleaning and the pump is mounted vertically on top of the tank.

An hydraulically operated work carriage rides on precision hand-scraped ways on the bed. Traverse speed is at the rate of from 3 inches to 250 inches per minute and constant speed is possible in either direction. Controlled deceleration and acceleration when starting, stopping, and reversing the carriage assures smooth, uniform operation. Practically all grinding requirements can be met by swivelling the universal wheel-head. This slides on a ground vee and flat way to provide accurate response to the feed mechanism.

The grinding wheel spindle rotates in Microsphere spindle bearings which require an extremely small amount of clearance and assure maximum accuracy as well as a quick positive sparkout period. The large handwheel for the feed is mounted at eye level for operator convenience. Both coarse and fine feeds are provided through the feeding mechanism. The coarse-feed dial is graduated in increments of 0.001 inch and the fine-feed dial in increments of 0.0001 inch.

Infinitely variable speeds from 60 to 360 R.P.M. are provided by the new headstock which is controlled from a dial on the front of the machine. Conversion from live-spindle to dead-spindle operation is accomplished by means of a special plunger and locking screw arrangement. The machine displayed was equipped with an automatic feeding mechanism, providing rapid approach to the work-piece and slow infeed.

One or more diameters and an adjoining face or shoulder can be ground in one operation on the new Type K Landis 10-inch plain cylindrical grinder with a 30-degree angle wheel-head shown in Fig. 2. This machine, also displayed for the first time at the Show, is a high-production unit with many unique features. The wheel-head slides on precision vee and flat ways which are permanently positioned at 30 degrees from the normal perpendicular setting. This arrangement permits both shoulder grinding and normal cylindrical grinding on parts at the same time. When required, multiple diameters plus shoulders can be ground simultaneously.

A newly designed hydraulic infeed mechanism provides auto-

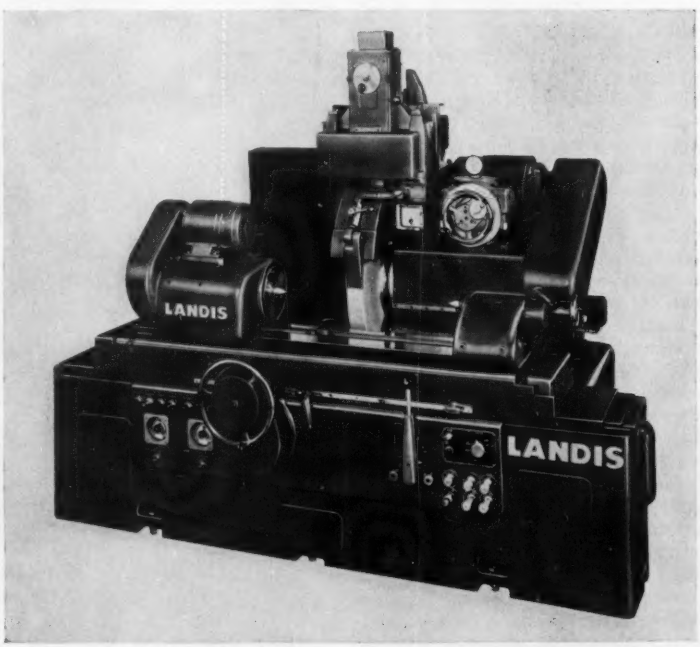


Fig. 2. Plain type Landis cylindrical grinder

matic rapid positioning of the wheel-head and a slow grinding-feed stroke which can be adjusted from zero to 0.200 inch on the diameter of the work.

The hand-feed mechanism for the wheel-head includes a large diameter handwheel with a graduated dial reading in thousandths of an inch. A fine-feed dial of the dividing head type which reads in ten-thousandths of an inch is also provided. Both dials and the handwheel are located at the operator's eye level. The horizontal and vertical feed-shafts are both mounted on pre-loaded anti-friction bearings. The machine exhibited had an overhead wheel-dressing arrangement with profile bar, cam, and cam follower to contour-dress the grinding wheel to the shape required by the work part.

Quick and easy positioning of the work headstock is provided by a rack and pinion. Two sturdy clamps give positive work-holding action and at the same time eliminate distortion. Proper braking is by means of a zero switch. Work speeds range from 54 to 200 R.P.M.

A single control lever is provided for all operations and lock-out positions for maximum safety. All controls for the grinder are located at the front of the machine where they can be easily seen and reached by the operator. A two-speed hand traverse mechanism is included, in addition to the hydraulically actuated traverse.

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Oakite Barrel Deburring Compound

A mildly acidic compound, designated Oakite FM 184, for barrel deburring, descaling and derusting has recently been introduced by Oakite Products, Inc., New York City. This new material was specifically designed by the Oakite laboratories to replace raw acids in barrel operations, where alkaline materials and abrasives are impractical because of time limitations. It is also designed to improve the color of steel after alkaline deburring; to remove heat scale from steel; and to brighten brass, either with or without the use of abrasive media. The compound is said to have good foaming properties at the recommended concentrations of 1 to 3 ounces to a gallon of water. It may be added dry to the burnishing barrel.

Circle Item 105 on postcard, page 239

Mona-Matic lathe with four-cut fully automatic work cycle introduced by Monarch Machine Tool Co.

Monarch Mona-Matic Lathe

A four-cut fully automatic work cycle, higher turning speeds, and greater cutting capacity are features of a new Model 21 Mona-Matic manufacturing lathe introduced at the Machine Tool Show by the Monarch Machine Tool Co., Sidney, Ohio. Although of heavier and more rugged construction than previous Mona-Matics, the electric multicycle programming control makes this new lathe simple and easy to operate. Once the work-piece is positioned in the machine and the starting button engaged by the operator, the lathe completes its cuts swiftly and automatically.

The heart of the multicycle programming control is a special cam stack which dictates the particular operating sequence desired. During operation, the multicycle programmer automatically regulates the cutting tools, carriage feed and traverse, the rear slide, and the air-gage tracer. Up to six different feeds, three rough cuts and one finish cut are available.

Adjustable limit type switches mounted on the carriage and actuated by the carriage movement give the electrical impulses required to index the multicycle programmer from one operating condition to the next during the automatic cycle. The programmer, together with the electronic components and related cycle control circuits, is housed in a separate control cabinet mounted on the rear of the tailstock leg. A control panel having feed selectors and a meter is conveniently positioned above the tailstock on a support member projecting from the control cabinet. Off-on, start-stop, and reverse switches for the operator are located at the apron.

The change from one type of work-piece to another requiring a completely different set of automatic operations can be readily accomplished in a matter of minutes by installing a new cam stack in the multicycle programmer and readjusting the position of the limit switches on the carriage. Increased cutting capacity is obtained by the use of a 20-H.P., alternating-current, main-drive motor. Direct drive to the spindle is through an hydraulic clutch and brake in the headstock. Interchangeable headstock gearing gives spindle speeds from 164 R.P.M. to 1880 R.P.M. Motor speeds are 600 and 1200 R.P.M.

The dual template air-gage tracer offers template control for the last rough cut and final finish cut, with adjustable stop dimensioning of the first and second rough cuts. Actuation of the rough-cut stops and shifting of the template holder are controlled by the multicycle programmer.

Work-piece set-up time is reduced by a special interlocking system between the machine's air-actuated tailstock and the air chuck on the headstock spindle. A single control lever at the tailstock moves the tailstock center into the work, clamps the air chuck, and locks the tailstock spindle. An independently powered chip conveyor for removing cutting chips during operation of the machine is offered as optional equipment.

Circle Item 106 on postcard, page 239

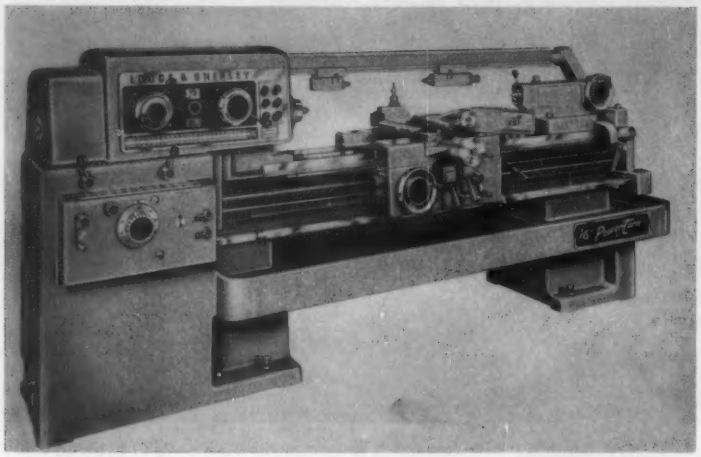

Fig. 1. Lodge & Shipley Powerturn 45-degree Copymatic lathe with new tracing mechanism

Lodge & Shipley Copymatic and Powerturn Lathes

A Powerturn 45-degree Copymatic of completely new design, with features of the previously introduced Copymatic and Powerturn lathes combined to provide unusual versatility, was among the ten machines displayed at the recent Machine Tool Show by the Lodge & Shipley Co., Cincinnati, Ohio. This new lathe will be manufactured in six models and sizes including engine, toolmaker and gap models in 16- and 20-inch standard sizes. The lathe on display at the show was the 16-inch Powerturn 45-degree toolmaker model shown in Fig. 1. It was exhibited in operation contour-turning a stepped motor shaft. The smooth contours with pronounced uniformity of feed marks produced by these lathes makes them particularly suited to turning contours involving diameters or bores and faces connected by curves. Either turning or facing operations or a combination of both can be easily performed on these machines.

The 45-degree Copymatic has a completely new tracing mechanism and template support. Its base-mounted tracing stylus is designed to simplify work loading and the sensitive, accurate control valve is of improved design. A new support provides for the use of either round or flat templates.

With the Copymatic design, all the control is given to the hydraulic cylinder which operates the tool slide. The carriage operates at a constant, uninterrupted speed, providing additional sensitivity. All hydraulic lines are enclosed in a flexible conduit. These lathes also have the new Lodge & Shipley computing head and Centri-trol developed for convenient, foolproof operation.

The Lodge & Shipley Powerturn 90-degree Copymatic lathe shown in Fig. 2, also displayed at the Machine Tool Show, will be manufactured in engine, toolmaker and gap models in 13-, 16- and 20-inch standard sizes. The 16-inch toolmaker model is shown in Fig. 2. The new features of this machine include a new template support for either round or flat templates. The support is positioned to clear the top of the lathe for work-piece loading and is designed to simplify template arrangements. The lathe is normally supplied with supports for round templates, since many users produce a prototype piece by a regular lathe operation and use it for a template.

The multiple hydraulic tubes

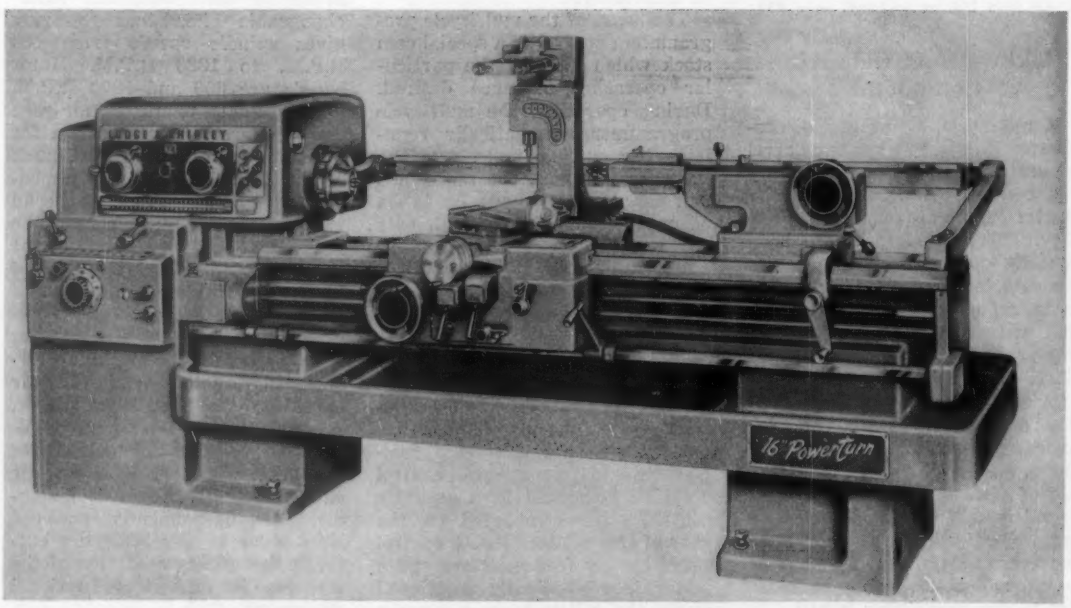

Fig. 2. Powerturn 90-degree Copymatic lathe displayed at show by the Lodge & Shipley Co.

used in the Copymatic control are all enclosed in a single flexible conduit which greatly simplifies control line handling. The hydraulic unit is positioned to eliminate interference with chip removal. The computing heads of these machines merely require the setting of two dials to obtain instantly the correct positions for the three speed-shifting levers. Another feature is the Centri-trol control with all push-buttons and control levers conveniently grouped and distinctively shaped to permit fast, fumble-free operation. The 90-degree Copymatic lathe was exhibited in operation, contour-turning steel valve plungers.

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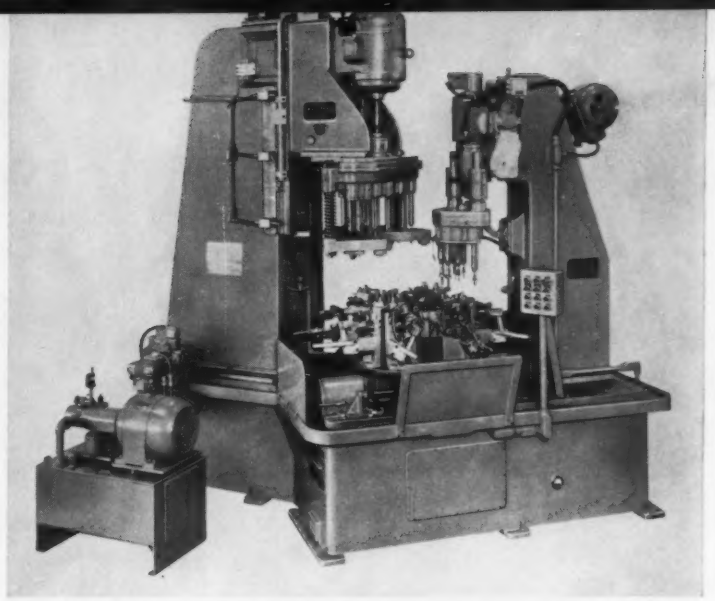


Special-purpose machine for processing steering knuckles built by the Hartford Special Machinery Co.

Machine Designed to Process Steering Knuckles

The Hartford Special Machinery Co., Hartford, Conn., has designed and built a four-station horizontal indexing machine incorporating the company's standard machine components. This machine is designed to perform drilling, chamfering, spot-facing and tapping operations on forged-steel steering knuckles. It will finish sixty steering knuckles per hour when operating at 100 per cent efficiency.

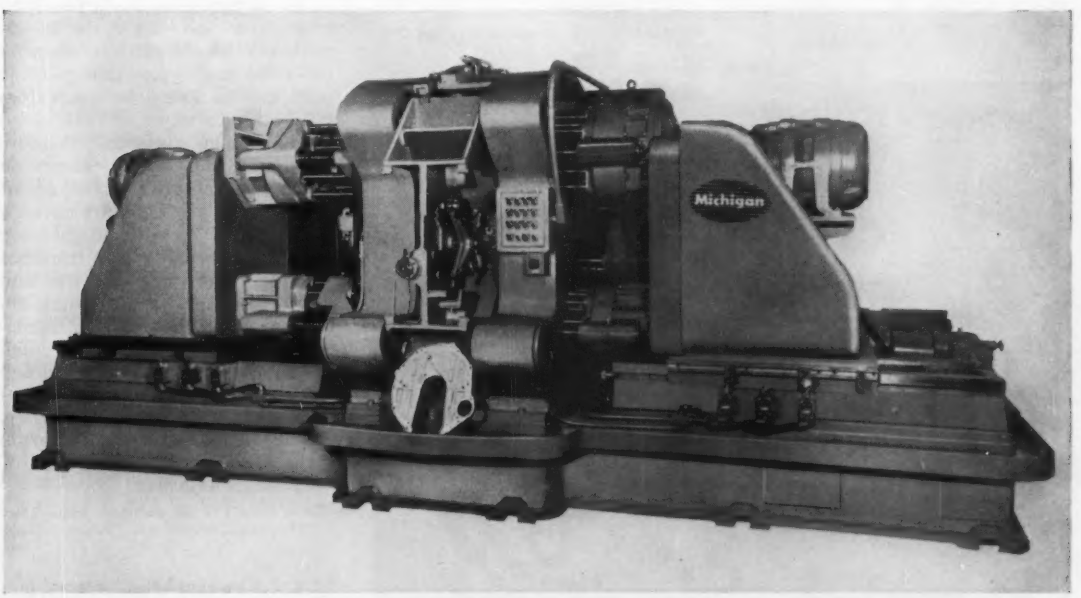
Circle Item 108 on postcard, page 239

Special Machine for Processing Adapter Plates

A special double-end trunnion machine for processing transmission adapter plates has been developed and built by the Michigan Drill Head Co., Detroit, Mich. This special four-station trunnion index machine drills, chamfers, and taps all mounting holes. It also rough-bores, finish-bores and chamfers the starter hole in 120 transmission adapter plates per hour.

The manufacturer's standard way type horizontal units are incorporated in the machine which is provided with automatic lubrication, as well as master gearboxes on both horizontal units. Long stroke units are used to allow the heads to be retracted out of the trunnion and to permit a quick change-over of tools when setting up for a new job.

Pot type heads were provided in each station so that in the event



Double-end trunnion machine for processing transmission adapter plates built by the Michigan Drill Head Co.

Fig. 1. Two-station vertical broaching machine built by the American Broach & Machine Co. for cutting helical internal involute teeth in automatic transmission gears

of a part change, or the addition of a new model, only these heads need to be changed. Hydraulic pressure fluid is fed through the center shaft of the trunnion by means of a specially designed rotary bushing to actuate power cylinders which automatically clamp the parts. The machine is designed for a central coolant system, with all chips dropping through the center of the machine to a conveyor. Electrical and hydraulic equipment conform to J.I.C. standards.

Circle Item 109 on postcard, page 239

Fig. 2. Checking helical internal involute teeth of idler gear broached on machine shown in Fig. 1

Two-Station Machine for Broaching Helical Gears

The internal helical teeth in reverse idler gears for automotive automatic transmissions were cut at a high production rate on a two-station vertical broaching machine demonstrated at the recent Machine Tool Show by the American Broach & Machine Co., a Division of Sundstrand Machine Tool Co., Ann Arbor, Mich. The 50-ton broaching machine, with a stroke of 72 inches, was arranged for two-station broaching with tube magazine feeds as shown in Fig. 1. Operating with its complete equipment of fixtures, broaches, chip conveyor, and magnetic chip separator, this VP-7-50-7 machine produced 140 pieces per hour at a broaching speed of 17 feet per minute. At the maximum broaching speed of 22 feet per minute, the machine can turn out approximately 200 pieces per hour.

The blanks to be broached are simply loaded into the two magazines of the machine and the operating cycle started by push-button control. Two parts are fed into the slide and transferred into the broaching positions. The broaches move up through the parts and are engaged by the pullers, which pull them through, cutting the helical involute teeth from solid stock. Upon completion of the cutting stroke, the slide moves the parts out and ejects them. After the broaches return, the slide picks up two more parts from the magazines and the cycle is repeated. With the machine running on automatic cycle, the operator only has to keep the magazines filled with parts.

The helical internal involute teeth of the idler gears shown on the inspection stand, Fig. 2, are of 14 diametral pitch and are cut on a 50-inch lead with the high-speed steel pull broaches. The broaches are 5 1/2 inches in diameter and 80 inches long. The broaching operation finishes the inside diameter concentric with the pitch diameter of the involute teeth and maintains the pitch diameter concentric with the outside diameter. After broaching, the internal teeth are shaved, 0.001 inch of stock being removed.

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Cross Special Machine for Processing Connecting-Rods

The Cross Company, Detroit, Mich., has developed a special machine for processing connecting-rods used in air-conditioning units. The machine has a capacity for handling four connecting-rods with different center distances and machining two sizes of connecting-rods in the same set-up. It is a dial type machine with the index-table operated by a fluid motor. There are four stations—one for loading and unloading, and three for machining operations.

Operations include drilling and rough- and finish-reaming the wrist-pin and crankpin holes. Pick-off gears are provided for changing the spindle speeds. Other features include hydraulic feed and rapid traverse, and automatic lubrication.

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Special machine built by The Cross Company for processing connecting-rods for air-conditioning units

Ex-Cell-O Vertical Precision Boring Machine

Two sides of one part, or one side of two different parts, can be machined simultaneously on the Style 432 vertical precision-boring machine announced by the Ex-Cell-O Corporation, Detroit, Mich. This machine will perform such operations as turning, facing, boring, grooving, and chamfering in combinations, or as separate operations. Each of two stations has a separate hydraulic system, counterweighted compound tool-slide, vertical spindle, drive equipment, and controls. During the machining operations at one station, the other station can be unloaded, loaded, and started on its automatic cycle. Individual controls and power equipment at each station prevent the operation of one station from affecting the other.

Vertical construction provides convenience in loading and unloading work, and adjusting or changing tools. Hollow spindle shafts permit the use of draw-bars or the operation of pneumatic chucks. Spindle speeds are easily changed with V-belt and pulley combinations. The desired machine cycles are obtained by positioning selector switches and adjustable dogs.

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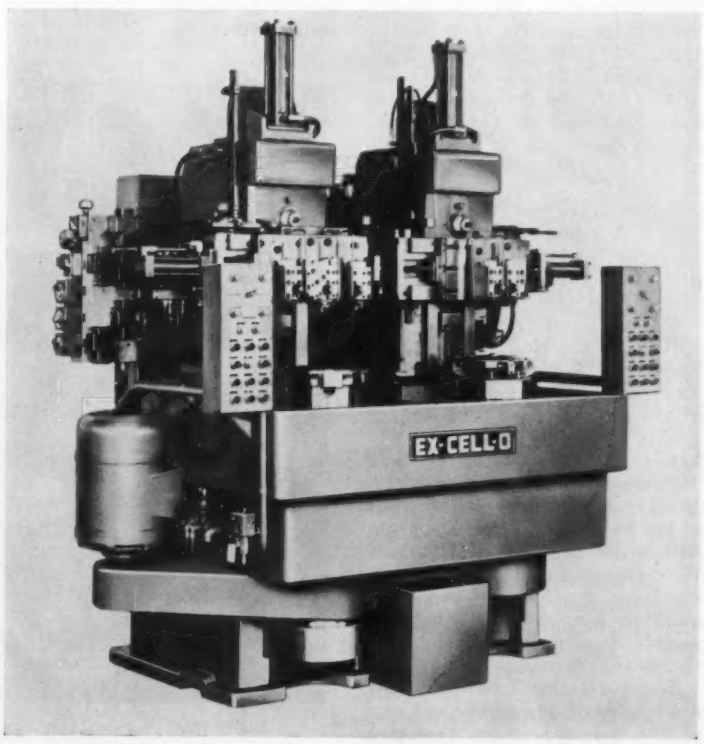

Two-station vertical precision boring machine which has been introduced by the Ex-Cell-O Corporation

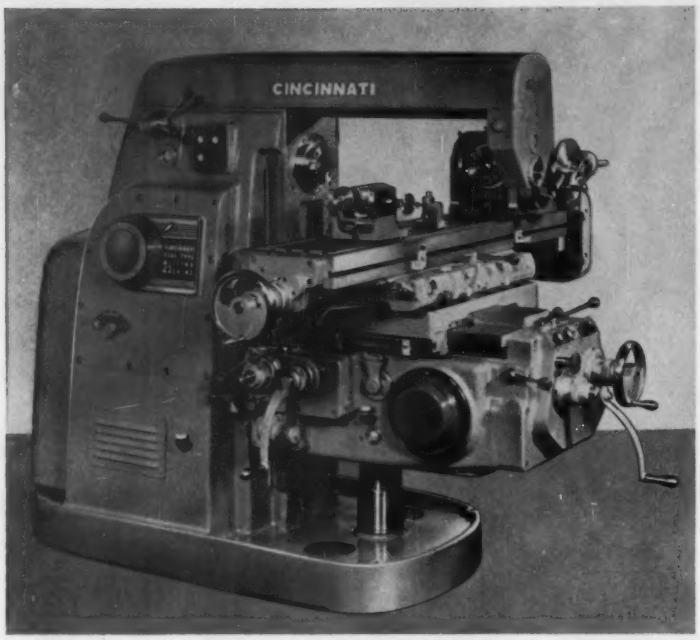

Fig. 1. Cincinnati No. 2 universal dial type milling machine

Cincinnati Dial Type Milling Machines

A line of dial type milling machines said to be new from the ground up has recently been introduced by the Cincinnati Milling Machine Co., Cincinnati, Ohio. The machines in this new line are much more powerful than the dial types of former designs. They have push-buttons to reduce operating effort and they offer a wide range of speeds and feeds for machining operations on light metals as well as on the newer and tougher alloys.

These machines are built in Nos. 2, 3, and 4 sizes and in plain, universal, and vertical styles for each size. Spindle speeds range from 18 to 1800 R.P.M. for the No. 2 size, and from 16 to 1600 R.P.M. for the Nos. 3 and 4 sizes. Speeds are indicated by an extra large dial on the left-hand side of the column. The speed desired is obtained by means of two push-buttons marked "increase" and "decrease" located at the "console" speed-change control on the front of the knee, or by duplicate push-buttons on the left-hand side of the column, as desired. The starting lever provided on preceding machines has been eliminated, and push-buttons now start and stop the spindle drive.

Three electrical control buttons are located on the right-hand side of the column, where they are built into the electrical compartment cover. They serve to start and stop the motor and to start and stop the coolant pump. A nearby disconnect switch is also built into the electrical compartment cover.

A new syncro-mesh principle is incorporated in the spindle drive to facilitate the shifting of gears. With this new drive the gears rotate constantly at a very slow speed while the motor is running, permitting easy shifting without any clashing noises. The spindle drive clutch and brake are hydraulically operated, and require no adjustment.

Thirty-two feeds ranging from 3/8 inch to 90 inches per minute, are selected by a knob at the front station, or a duplicate knob at the rear operating station. An extra large feed-indicator dial located on the side of the knee is clearly visible from both operating stations. Power rapid traverse is at the rate of 150 inches per minute (table and cross). Feeds and rapid traverse are now powered by an independent 3-H.P. motor mounted on the knee. This drive is designed to simplify maintenance problems and permit the full power of the main drive motor to be transmitted to the spindle. The feed-box is a self-contained unit, mounted in the knee section of the machine.

The cutting fluid pump is now individually motor-driven. Plain and vertical machines are available with and without automatic table cycles. When equipped with this feature, the machine retains all its characteristics of versatility for a variety of tool-room milling

Fig. 2. Plain dial type version of machine which is shown in Fig. 1

work and, in addition, a single four-position lever is provided for manual table control. Automatic cycle machines may be tooled up with one fixture for one-way single cycles, or fixtures at both ends of the table for two-way reciprocal milling, either continuous or with center safety stop. The latter type of cycle is possible because of the automatic backlash device. A new type of spring clutch on the table feed-screw serves to insure smooth and positive instantaneous engagement of feeds at the higher rates.

Additional operating safety features include an automatic knock-out for the table handwheel and an interlock arrangement in the rear hand-crank sockets for the cross and vertical traverse movements. These safety devices prevent the handwheel and the hand-crank feeds from being operated when corresponding power feeds are engaged and also prevent the power feed from being engaged when a corresponding hand feed is in use.

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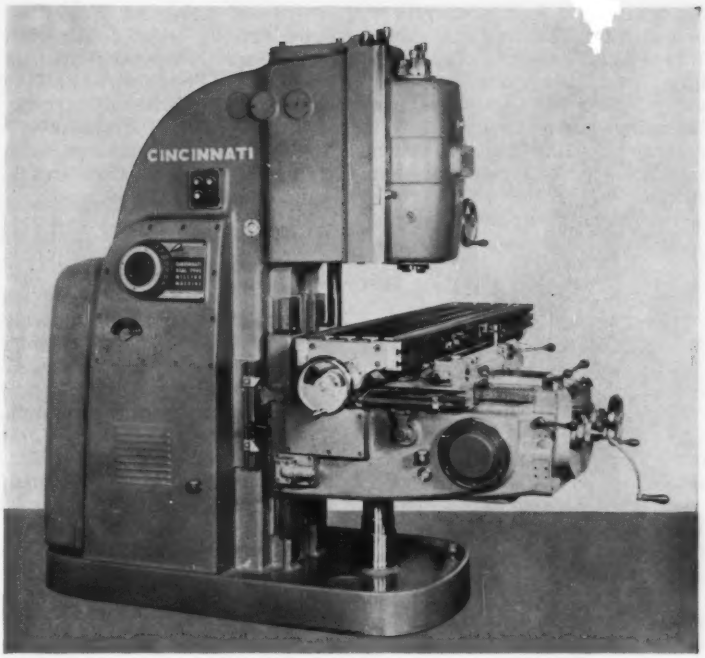

Fig. 3. Cincinnati vertical dial type milling machine

Screw Machine of "Unit-Construction" Design

A new feature of the recently introduced Detroit Screwmatic 750 single-spindle automatic has been announced by the Gear Grinding Machine Co., Detroit, Mich. This new feature, known as "unit-construction," has been developed to eliminate the obsolescence of screw machines and to decrease capital expenditures for new equipment.

Ten individual units, including the machine base, comprise the new Screwmatic 750 automatic screw machine. When improvements or innovations are introduced, they will be designed for incorporation in the separate units of this machine. The user need only change the unit or units affected by the new development in order to have the latest in screw machine design at a nominal cost. For example, should a new spindle design be developed for faster working speed, the older unit can be quickly and economically replaced with a newly designed unit.

The ten individual units are: spindle housing, chucking and trip lever assembly; main spindle unit; vertical slide attachment; spindle drive gear-box; machine base; front and rear cross-slides; six-position turret; "Adjusto Speed Drive" motor; camshaft and indexing drive unit; and turret slide assembly.

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Automatic screw machine brought out by Gear Grinding Machine Co.

Portable Balancing Machine

"On the spot" balancing of rotating parts can be accomplished by a portable balancer recently developed by the Tinius Olsen Testing Machine Co., Willow Grove, Pa. This compact, self-contained unit provides a means for balancing many parts which can-

not be handled economically in a precision type balancing machine. It is especially useful in balancing large parts. Complete vibration analysis, as well as dynamic balancing, can be done easily yet accurately on this machine which is capable of balancing parts at speeds of 250 R.P.M.

The angular location and the amount of correction weight required in two selected correction planes are determined without guesswork. The entire unit is housed in a lightweight carrying case, and consists of one inertia type pick-up, a stroboscope light, an amplifier with range switch, and all necessary cables.

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H-P-M Plastics Injection Molding Press

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has announced a Model 300-H-12 plastics injection molding machine which has a capacity of 12 to 16 ounces and is said to be the fastest machine of its size available. The new machine features a high injection speed of 1150 cubic inches of material per minute; a mold mounting area of 30 inches by 20 inches; and a 20-inch mold clamp stroke.

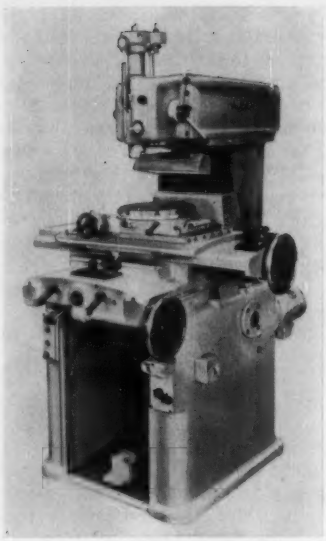
This machine is available for either semi-automatic or fully automatic operation. An extremely accurate weighing type feeder of a compensating design can be furnished as optional extra equipment. The plasticizing capacity of the machine for polystyrene is 135 pounds per hour permitting fast cycling even on the big shots. A new, extremely high output plasticizing chamber is equipped with three heat zones, each pyrometer-controlled. Heating bands are mounted directly on the spreader insuring evenly plasticized material. The heating chamber can be easily removed from the machine.

A front limit switch panel, directly below the oil tank, permits all stroke adjustments to be made at the front of the machine. All hydraulic components are mounted in the open for easy accessibility. A separate control panel which houses all of the electrical controls can be located any place in the proximity of the machine.

Circle Item 116 on postcard, page 239

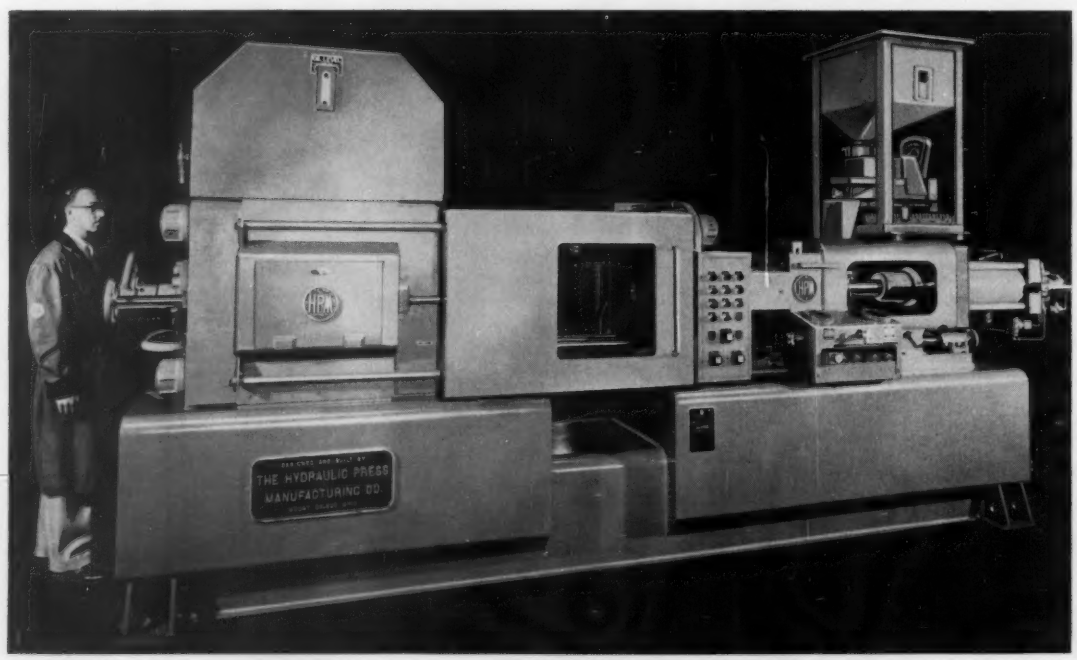
Precision Jig Borer

A Hauser 3BA precision jig borer, which retains the sensitivity and easy control of the preceding 2BA machine but which has many new features developed to greatly increase its range and usefulness, has been announced by Carl Hirschmann Co., Inc., Manhasset, N. Y. Among the advantages claimed for this new machine are greater boring capacity, greater height adjustment, heavier quill, larger table surface and greater table travel.



Hauser jig-boring machine introduced in this country by Carl Hirschmann Co. Inc.

The table of this jig borer has a working surface 21 3/4 by 12 3/4



High-speed plastics injection molding press announced by the Hydraulic Press Mfg. Co.

inches and a longitudinal travel of 15 3/4 inches. The transverse slide has a travel of 10 inches. The maximum distance from the boring spindle to the table is 23 1/2 inches, the adjustment of the vertical slide 15 inches, and the vertical travel of the boring spindle 5 1/8 inches. Standard equipment includes dial indicator locating attachment, locating microscope, wedges, drill-guide attachment, and setting blocks.

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Niagara Gap-Frame Double-Crank Presses for Work Requiring Long Dies

Double-crank presses having abundant die area, unusual accessibility and convenient work handling features built in two types —upright (Series B), Fig. 1, and open-back inclinable (Series BI), Fig. 2—have been announced by the Niagara Machine & Tool Works, Buffalo, N. Y. This line of presses is suitable for a variety of work involving long, progressive dies, multiple-station dies, and automatic feeds.

Drawing operations can also be performed when the presses are equipped with Niagara die cushions. Standard capacities range from 45 to 200 tons.

A wide, all-welded steel, box type slide, fully contained within the gibbing, rigidly supports the punches. Overhanging flanges are eliminated. Two rugged connections directly resist any tendency of the slide to tilt under off-center loading, thereby minimizing misalignment of the dies. The rigid, integrally built, all-welded steel, stress-relieved frame properly resists deflection.

Circle Item 118 on postcard, page 239

Hamilton Hobbing Machine of "Alternate" Design

The Hamilton Tool Co., Hamilton, Ohio, has announced the development of an "alternate" design for its No. 1 small precision gear-hobbing machine. The new feature, which is optional at no extra cost, adapts this hobbing machine to the use of existing work-holding fixtures and tooling regardless of the style or make of hobbing machine for which such equipment was originally constructed. This development is intended to eliminate loss occasioned by the scrapping of existing work-holding fixtures in order to obtain the independent selection of speeds, feeds, and indexing features of the Hamilton No. 1 small precision gear-hobbing machine.

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Hamilton gear-hobbing machine available in "alternate" design

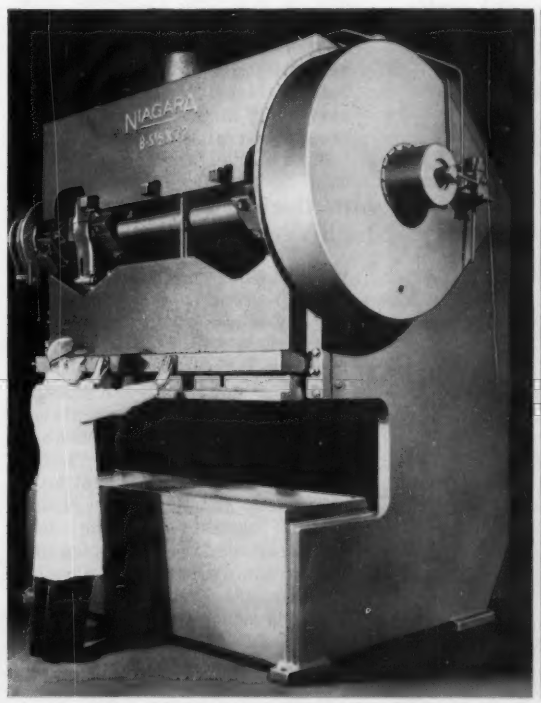


Fig. 1. Niagara gap-frame double-crank press

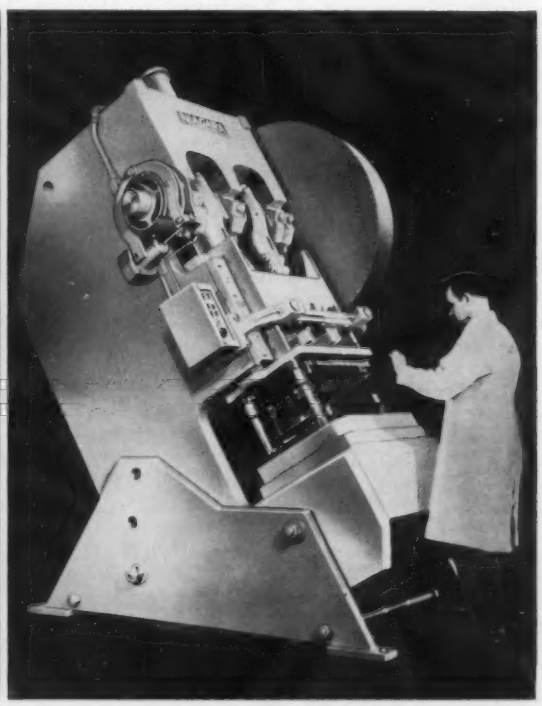
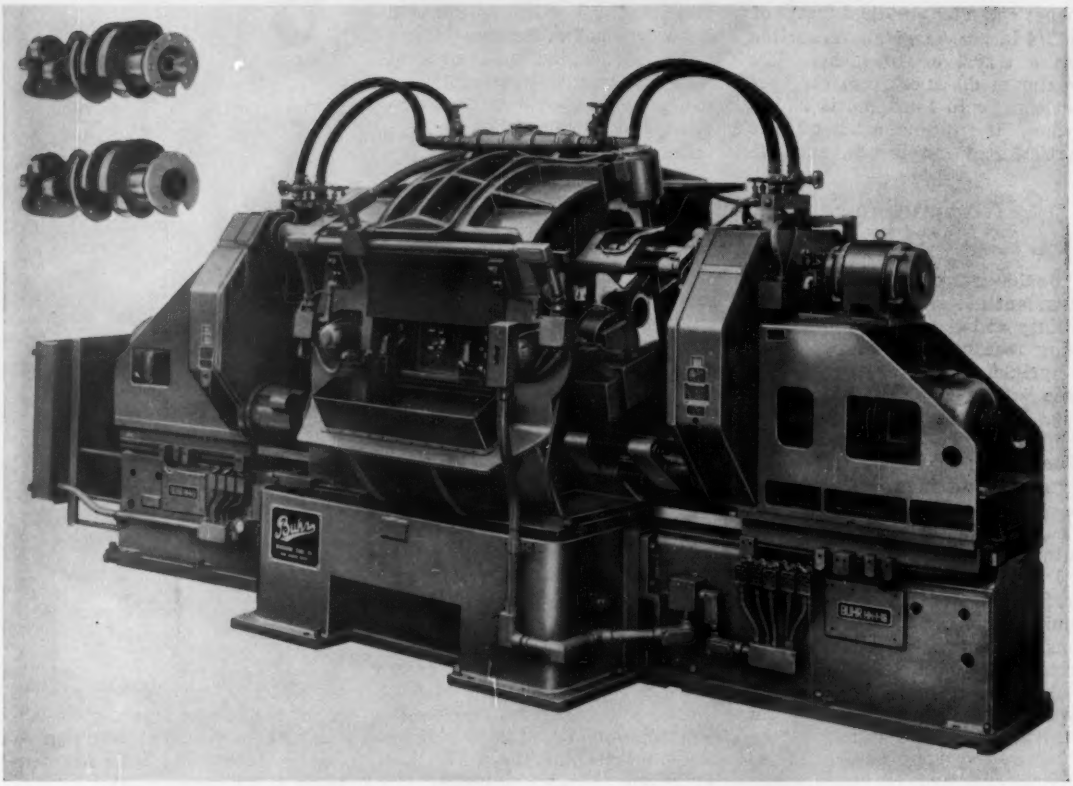


Fig. 2. Gap-frame double-crank inclinable press



Buhr "Economatic" built for rapid processing of engine crankshaft

Buhr "Economatic" Equipped to Machine Crankshafts

Thirty-four operations on seventy pieces per hour at an operating efficiency of 100 per cent are performed on Plymouth engine crankshafts by a two-way "Economatic" built by the Buhr Machine Tool Co., Ann Arbor, Mich. The machine performs thirty operations from the left-hand side and four from the right-hand side. Outstanding features include: Powerflo indexing; power clamping of fixtures by means of a power wrench with torque control; multiple heads of master gear-box construction with individual cluster heads; and bushing plates which register in fixtures at each station.

The thirty operations performed from the left-hand side of the machine include drilling one 27/64-inch hole, one 57/64-inch hole, and seven 7/16-inch holes; facing center hole to a 30-degree angular seat and drilling to a diameter of 27/32 inch and countersinking eight holes; reaming seven 0.4533-inch holes, one 0.9085- to 0.9090-inch hole to depth, and one 0.4402-inch hole; and countersinking one hole to an included angle of 60 degrees.

Operations performed on the right-hand side consist of drilling one 1 1/16-inch hole, spot-facing one 1 5/8-inch diameter hole, counterboring one 13/16-inch hole and forming a 60-degree seat. All parts of this machine are held to close tolerances and are completely interchangeable. Each

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Giddings & Lewis Horizontal Boring, Drilling, and Milling Machine, and 42-Inch Vertical Turret Lathe

Among the eight new machines valued at more than a million dollars which were exhibited by the Giddings & Lewis Machine Tool Co., at the recent Machine Tool Show, there were two not illustrated in MACHINERY'S Show Number. These machines are shown in Figs. 1 and 2. The 350-T table type horizontal boring, drilling, and milling machine, Fig. 1, is equipped with extended saddle, saddle supports and over the floor type auxiliary runways. This machine performed a number of boring and milling operations made easier by the use of a 48-inch "Air-Lift" rotary table. Large-diameter boring and facing was performed with a 26-inch continuous-feed facing and boring head using telescoping tools. A fast-acting automatic electric positioning device was used to control machine table and headstock movements with precision.

One of the many outstanding 350-T machine improvements introduced at the Machine Tool Show was the revolutionary "Lubri-Cool" system. By circulating a continuous supply of refrigerant-cooled lubricant through both headstock and milling feed-unit gear trains, this system gave results equal to, or better than, those obtained when operating the machine in an air-conditioned room.

The extremely high production potentials of the Giddings & Lewis 42-inch vertical turret lathe shown in Fig. 2 were demonstrated in a

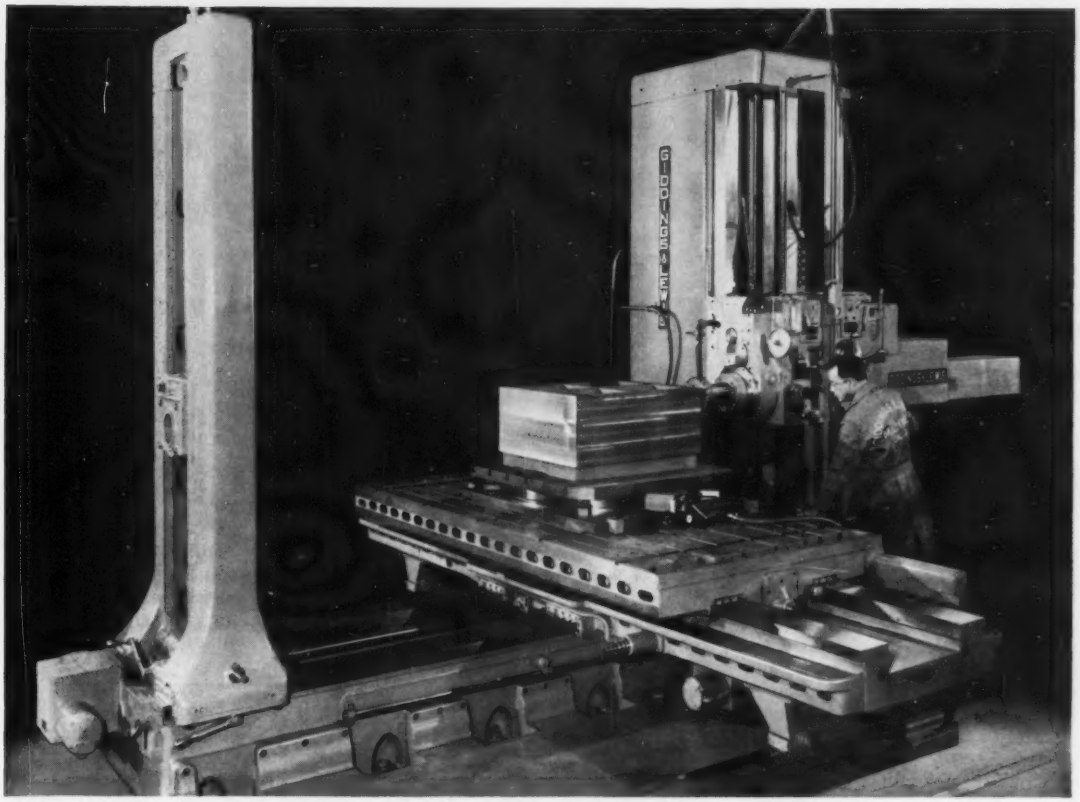

Fig. 1. Giddings & Lewis table type boring, drilling and milling machine

variety of turning, boring, facing, and chamfering operations performed on a 36-inch diameter steel work-piece. Among the many features which contribute to the machine's extraordinary savings in floor to floor time on production operations are: independent feed and traverse functions for each individual head, controlled from a single directional lever or joy stick; exclusive, electric clutch-controlled planetary transmission permitting control of both speed and feed shafts while table is rotating and while any head is taking its cut; coaxial micrometer dials with circular scales located on each head's control panel, each arranged with five automatic feed stops to record the extent of head feed in both directions; and power chuck, electrically operated from pendant control button and featuring a self-locking mechanical screw mechanism for holding work subjected to severe cuts.

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Fig. 2. G & L vertical turret lathe developed for high-speed production

Greaves Milling Machine and Attachments

Two drive motors instead of one, and other construction features designed to provide more and smoother power at the cutter, are advantages claimed for a new No. 2-XH horizontal milling machine manufactured by the Greaves Machine Tool Division, J. A. Fay & Egan Co., Cincinnati, Ohio. This machine, Fig. 1, was shown for the first time at the recent Machine Tool Show in Chicago. It is available in both plain and universal models. A separate drive motor mounted in the knee provides power for the knee, saddle, and table while the usual column-mounted motor drives the horizontal spindle. This two-motor arrangement serves to eliminate power losses.

The horizontal spindle has three bearings, including two Timken tapered roller bearings near the front end of the spindle. The spindle support is thus concentrated near the work-piece. The combination of separate drive motor and maximum frontal spindle support is designed to insure a smooth running spindle with substantial power.

Other important features include centralized power controls for all directional feeds, totally enclosed vertical screw for maximum protection against damage by chips, push-button spindle rotation directional control, and electric lever control for jog, stop, and continuous operation.

Also included are a wide range of speeds and feeds for all types of work; 20-inch vertical table travel; one-shot plunger lubrication to table saddle, and knee; coolant sump with built-in filtering unit; and feed-change controls mounted on front of knee for easy access.

A control accessory, available for Greaves horizontal milling machines, which has been developed to make set-ups easier and faster is shown in Fig. 2. It enables the operator to engage and disengage the machine's operating mechanisms while adjusting cutter and table positions, and changing speeds and feeds. This clutch control is mounted on the side of the milling machine column. The control lever extends forward where it can be easily reached by the operator in normal operating position. This lever is mounted in a four-position vertical connection and may be adjusted to any of four positions for operating convenience by lifting and moving it to the desired position. The multiple-disc type clutch is mounted on the main drive-shaft of the machine to provide positive, dependable action.

The heavy-duty vertical milling attachment shown in Fig. 3 can be mounted directly on Greaves horizontal milling machines. It can be used for all types of vertical milling operations. The unit has an extra-heavy head, with the spindle mounted in Timken roller bearings. For convenience and ease of operation, the attachment spindle has a No. 50 N. S. taper which is the same as in the milling machine. Arbors, collets, and adapters used on the machine also fit the vertical attachment.

Only three bolts are required to fasten the unit to the face of the machine column. The standard over-arm and arbor support may be used to provide extra strength and rigidity for heavy milling. The attachment head housing is graduated and swivels to permit rotation of the head. The cutter may be set at any position through an angle of 360 degrees and is positively locked by four equidistant clamping bolts. The spindle speed of the attachment is the same as that of the machine spindle. The attachment is available with crane and parking unit.

Extra clearance for operations on larger work-pieces is provided by the offset vertical milling attachment shown in Fig. 4. This attachment provides up to 4 1/2 inches additional vertical clearance through utilization of an offset head on the attachment. The unit is mounted on the column face of the horizontal milling machine and is driven directly from

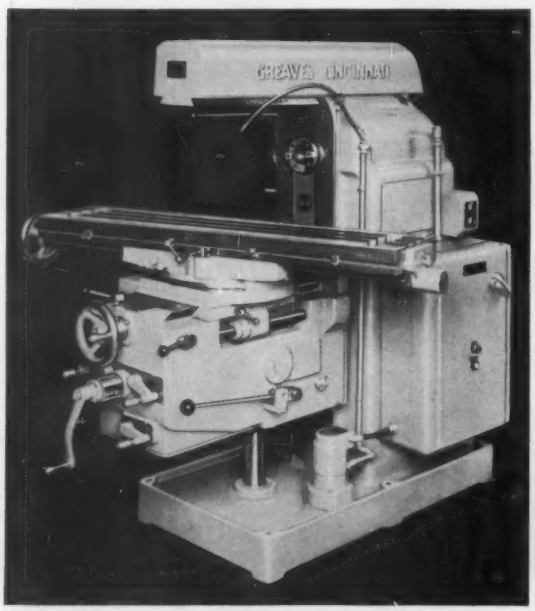

Fig. 1. Greaves horizontal milling machine

Fig. 2. Machine having a new clutch control

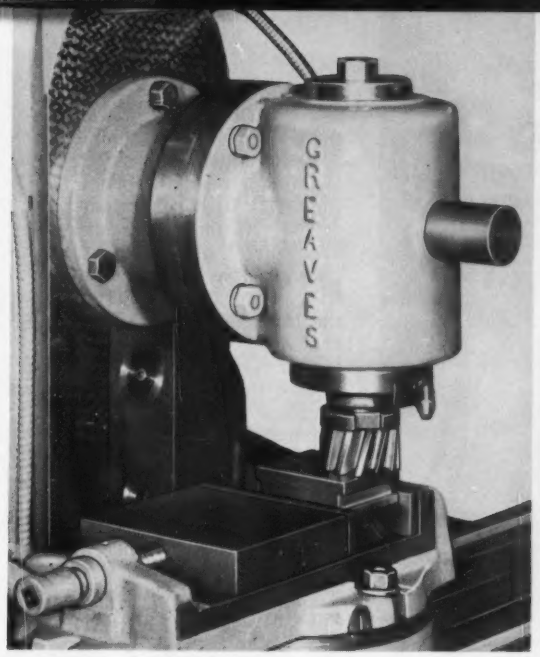

Fig. 3. Greaves vertical milling attachment

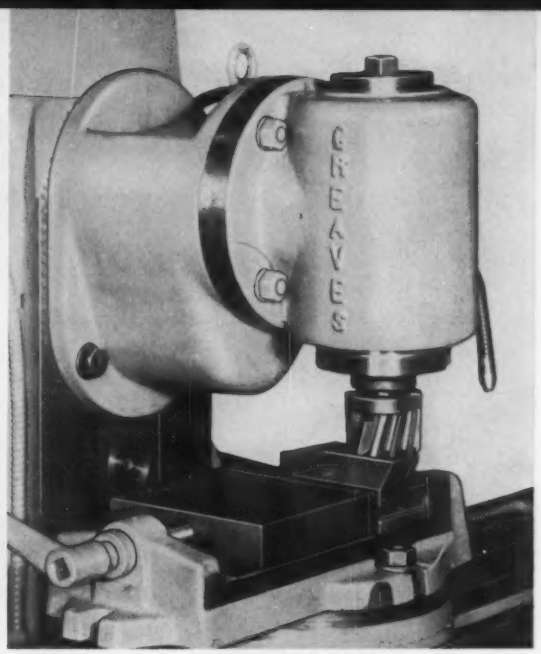

Fig. 4. Heavy-duty offset milling attachment

the machine spindle. Gearing provides for mounting the vertical spindle higher than the point of drive, thus giving additional capacity between the vertical spindle and the machine table. The head of this attachment may also be swiveled through an angle of 360 degrees.

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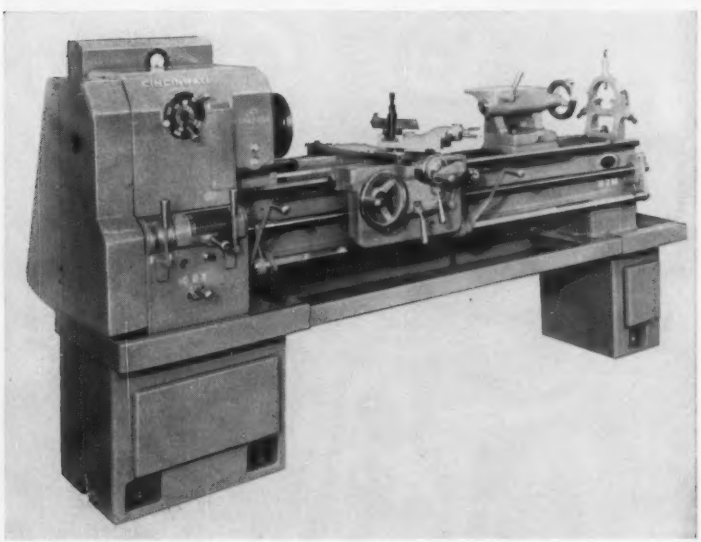
Cincinnati Geared-Head Engine Lathe

The new all-geared head, Model LE "Tray-Top" engine lathe displayed at the Chicago Machine Tool Show by the Cincinnati Lathe & Tool Co., Cincinnati, Ohio, is being built in 10-, 15-, and 18-inch sizes. These machines have been designed to provide the metalworking industry with modern, low-cost equipment for manufacturing, maintenance, and toolroom use. They have twelve spindle speeds in geometric progression, with a three-lever, color-match, direct-reading shift mechanism. The spindle, with its long taper key-drive nose, is rigidly mounted in three precision antifriction bearings. All headstock bearings are pressure-lubricated with filtered oil.



Geared-head "Tray-Top" lathe of new line introduced by the Cincinnati Lathe & Tool Co.

There are forty-eight thread and feed changes which are made available through a totally enclosed, automatically lubricated quick-change gear-box. The apron is a one-piece, double-walled casting with automatic lubrication. Longitudinal and cross feeds are engaged with drop levers which operate positive jaw clutches. A spindle start-stop control lever is supplied at the apron as well as on the change-gear box.

The bedways are ground and will be "Hardclad" flame-hardened on demand. Lubrication of the carriage ways and cross-slide is provided by an oil-shot system in the apron. A fully enclosed electrical compartment provides a safe and accessible place for the electrical control equipment. A built-in disconnect switch prevents exposing a live panel. Power is transformed from 220 volts and over to provide 110 volts at the push-buttons. The lathes are offered with a 1-, 1 1/2-, 2-, or 3-H.P. motor mounted on the rear of the headstock leg. "Tray-Tops" on headstock and tailstock provide space for micrometers, tools, drawings, and gages. Recessed, precision type, built-in leveling jacks and cabinet legs with easy-opening doors are regular equipment.

Circle Item 123 on postcard, page 239

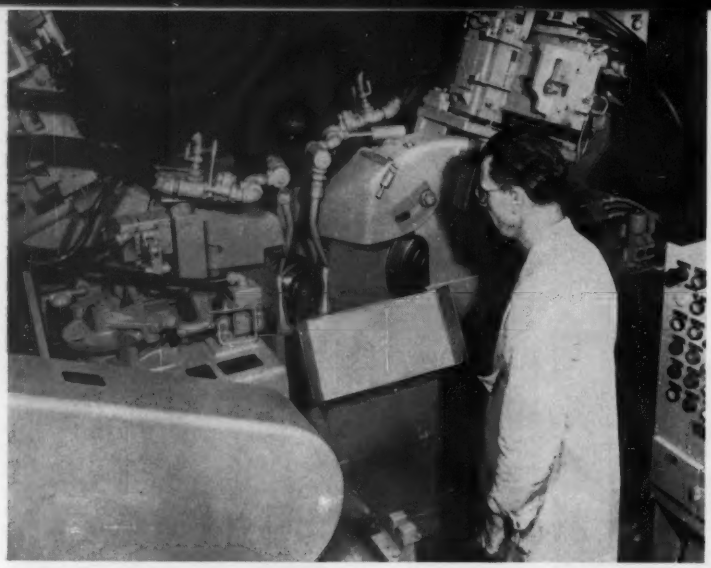


Fig. 1. Norton special purpose semi-automatic cylindrical grinding machine

Norton Cylindrical Grinding Machine and High-Production Hyprolap

The Norton Co., Worcester, Mass., has brought out a special purpose grinder, Fig. 1, which can be adapted to a wide range of cylindrical grinding operations. The principle advantage of this Type CMS-1 semi-automatic multi-wheel-slide machine is its ability to plunge-grind multiple diameters simultaneously on work-pieces which, because of their shape, do not lend themselves to grinding on conventional multi-wheel machines.

The sturdy, unitized wheel-slides which are positioned during manufacture for the requirements of a specific job may be opposed or placed in line. Provision is made for slight angular or lateral adjustment for set-up purposes. The slides are self-contained with respect to motion and truing but operate in unison during production. Centrally located "one-lever" control of the automatic grinding cycle and automatic termination of the cycle under electrically timed control greatly simplify operation.

Each wheel-slide has one or more 30-inch diameter grinding wheels as the nature of the job requires. The type of work-holding equipment furnished also depends on the job. Chucking arrangements on a single work-head, or equipment for holding the work on centers, can be supplied.

Two-rate automatic feed provides for rapid stock removal, work-piece accuracy, and finish. Convenient wheel-feed handwheels with click-count indexing mechanisms which permit feed adjustments in increments of 0.0001 inch without visual attention, simplify size control in set-up and initial operations. Individual push-button operated jogging control of wheel-slide movement aids production by simplifying size control during regular operation. The increments of jogging control are adjustable and all wheel-slide feeds occur with uniform accuracy.

Automatic wheel-truing by wheel-guard type devices assures efficient, effortless performance of the truing function. Compensation of wheel-slide setting for the amount of wheel diameter reduction after truing is automatic.

The Norton Co.'s No. 48F "Hyprolap" high-production lapping machine illustrated in Fig. 2, was shown for the first time at the National Machine Tool Builders Show. This machine is designed for either single- or parallel-face flat lapping. It can be arranged for a plain, timed cycle; automatic continuous feed; or semi-automatic continuous feed.

New features are said to provide the means for handling a greater range in work-piece size at a more productive rate and with far less operator attention than was possible with equipment previously available.

For single-face lapping the machine uses a single 48-inch diameter bonded abrasive wheel lap on a rigidly supported, heavy-duty, vertical spindle. Work-pieces are retained in suitable adapters and proper lapping pressure secured through weights or pressure devices as required. Trueness of the lap face is obtained by the generating method and is maintained by a hydraulically operated diamond truing arm.

Opposed parallel flat faces can be lapped in this machine simultaneously. For this operation a massive column and over-arm ar-

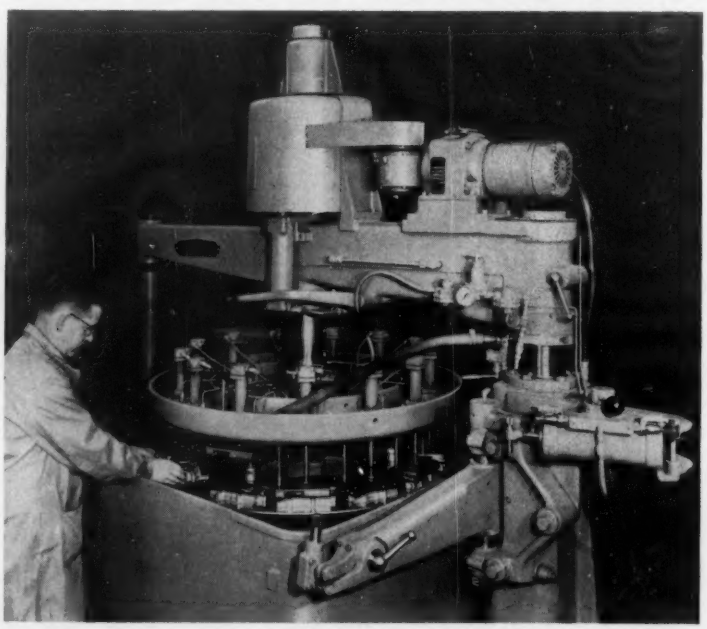


Fig. 2. "Hyprolap" high-production lapping machine placed on the market by the Norton Co.

rangement is provided to support the upper 48-inch diameter lap. Work-pieces are held in retainers between the two laps. Sizing is controlled by raising the lower lap with the Norton click-count indexing wheel-feed arrangement which has rotating full-nut engagement with a feed-screw. Both hand and power feed are provided.

The plain, timed-cycle arrangement uses an electric timer to control the machine cycle. The operator merely removes finished parts, inserts rough parts, and then presses a push-button to start the cycle which is terminated automatically by the timer. With the semi-automatic continuous feed arrangement, the operator removes finished work-pieces and replaces them with new parts as the lapping is done continuously in a single-pass through the laps. The automatic continuous feed arrangement eliminates the loading and unloading functions of the operator and places them in automatic handling equipment. The machine employs bonded abrasive wheel laps in conjunction with filtered coolant. Individual adjustable-speed drives for both laps and the work-holder provide flexibility.

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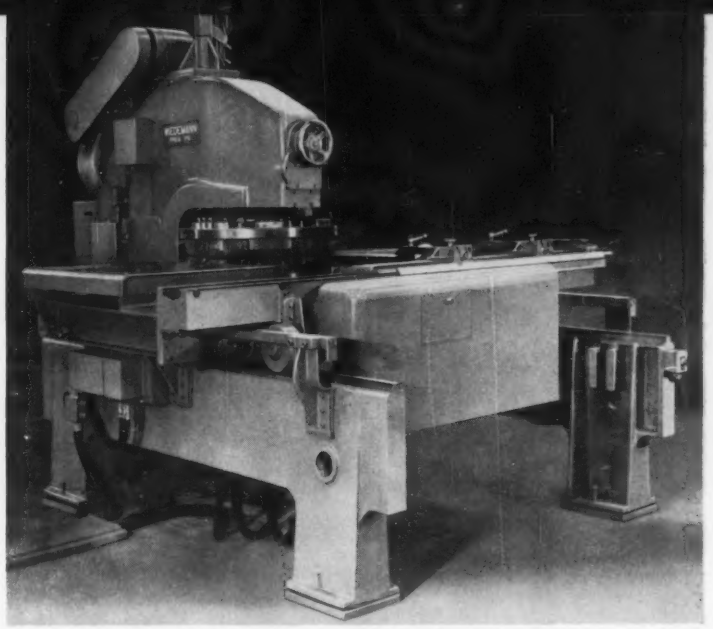

Fig. 1. Wiedemann automatic turret punch press controlled by tape-fed programming unit

Wiedemann Automatic Turret Punch Press

A completely automatic turret punch press with a capacity of 40 tons and throat depth of 33 inches was introduced at the Machine Tool Show by Wiedemann Machine Co., Philadelphia, Pa.

With this unique, automatic press, Fig. 1, complicated hole patterns, including openings of many sizes and shapes, are located and punched in large steel sheets with great speed and facility. The operator merely loads the material and unloads the finished work.

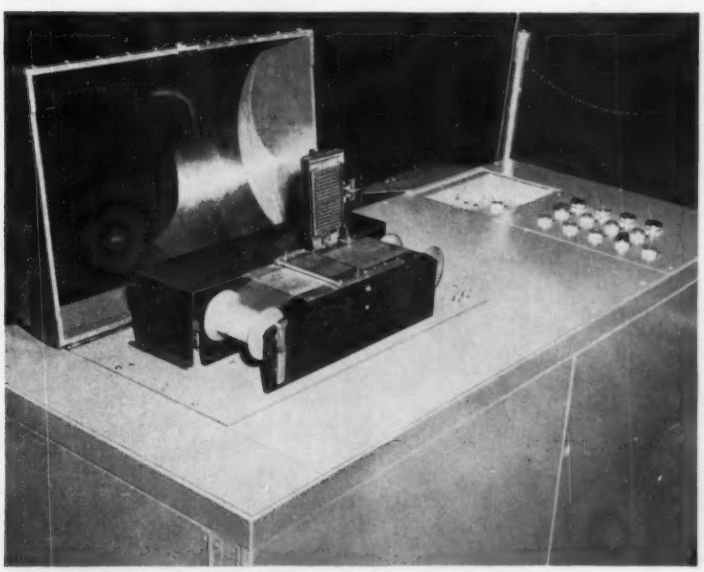

Fig. 2. Electromechanical programming unit which controls functions of turret punch press shown in Fig. 1

The press and the work locating table are controlled by a tape-fed, electromechanical programming unit shown in Fig. 2. This unit causes all functions to be performed automatically—simultaneously positioning work under the punch, selecting turret station carrying proper punch and die (any one of twenty dies in sizes up to 6 inches square) and, then, tripping the press. This cycle is automatically repeated in rapid sequence until all holes are accurately located and punched. Thus the use of this equipment reduces press operation to push-button simplicity and virtually eliminates operator fatigue.

Setting up consists of placing the desired tape in the programmer and loading the material on the table. The material is positioned by the operator to mechanical zeroing stops and clamped in position in a matter of seconds.

The special vinyl tape, which is not affected by shop oils or grease, eliminates the need for shop drawings, templates or time consuming manual lay-out of each hole location. The complete job is controlled by the punched tape. This tape, once prepared, becomes the template for the job. On completion of a production run, the tape can be filed for subsequent use on a new order. Since the entire job is contained on one tape, no part of the job information can be lost or misplaced. Changes can be made in the tape to suit alterations in the original hole lay-out.

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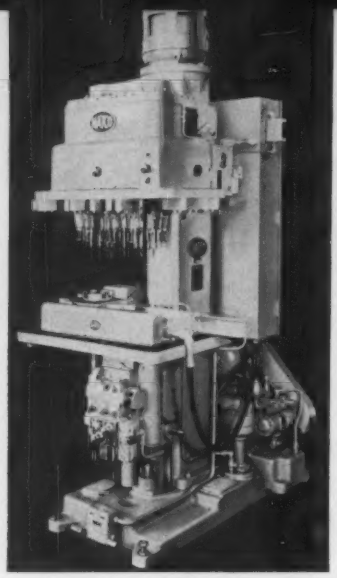

Multi-spindle machine built by the National Automatic Tool Co.

Natco Multi-Spindle Drilling and Tapping Machine

The development of a light drilling machine which combines the operations of three machines in one has been announced by the National Automatic Tool Co., Inc., Richmond, Ind. This sensitive, adjustable, multi-spindle drilling and tapping machine with a three-position automatic fixture slide, drills, chamfers and taps holes automatically.

A typical operating cycle of the machine consists of: load part at first position, rapid traverse, feed drill forward, rapid reverse and index to second position; rapid traverse, feed forward for chamfering cut, rapid reverse, and index to third position; rapid traverse, feed tap forward, reverse feed, rapid traverse in reverse and index to first or starting position.

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Roy Automatic Slotting and Deburring Machine

A machine that automatically slots, deburrs, and delivers up to 720 screws per minute, recently announced by Gros-ite Industries, Inc., Farmington, Conn., is being placed on the market by Roy Machinery & Sales, Inc., Farmington, Conn. This slotter is said to represent a basically new machine for the screw industry, incorporating many unique features including a work carrier wheel which permits change-overs to be made in minutes and which covers the entire working range of the machine. A newly designed, removable hopper which is completely jamproof carries work to the saw.

The saw is electronically controlled with all-electronic drives permitting the work carrier and saw to have four easily set production speeds ranging from 108 to 720 screws per minute. The machine has frictionless bearings and the large coolant tank is equipped with a motorized pumping unit.

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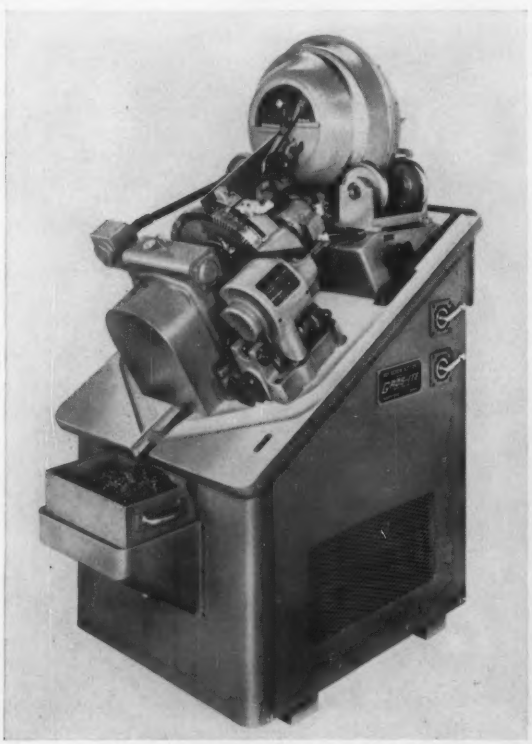
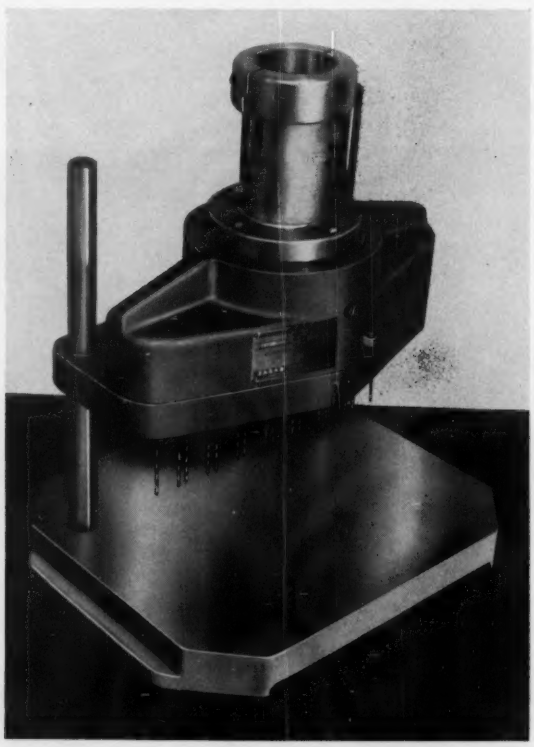
"In-Line" Gearless Drill Heads

Zagar Tool, Inc., Cleveland, Ohio, has added another series of "In-Line" drill heads to its regular line of standard gearless drill heads. The new drill heads are designed for drilling, tapping, or reaming holes in a straight line in an elongated pattern. Any size hole from 1/8 to 3/4 inch in diameter can be drilled in any machinable material and the spacing of the spindles can be as close as the sum of the diameters of the two smallest holes to be drilled or tapped.

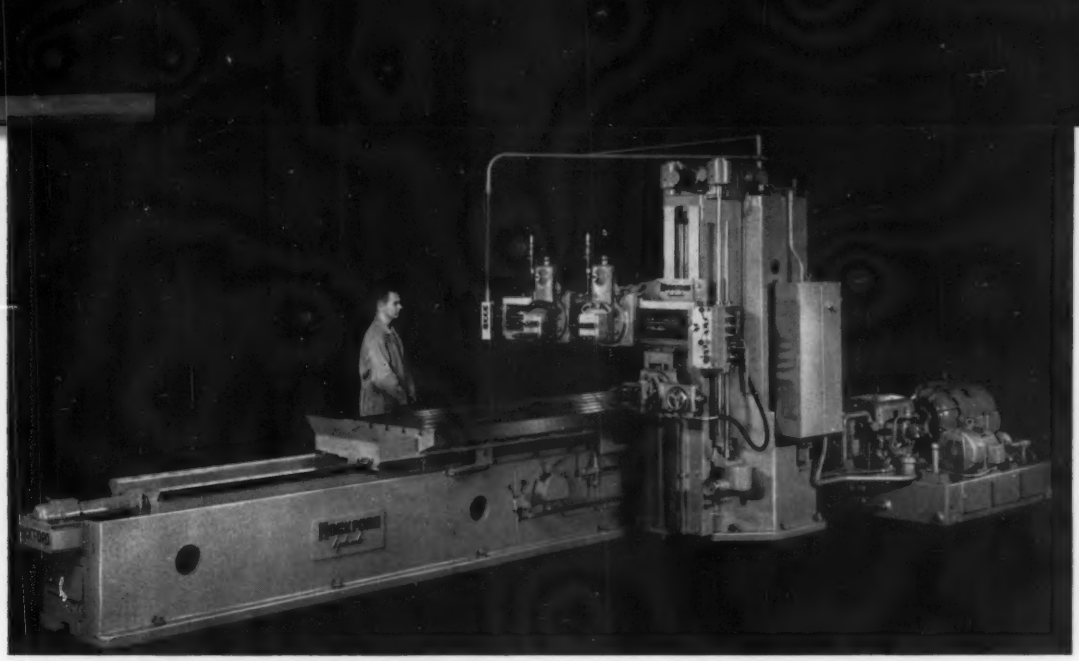
Simultaneous multiple-hole drill-



Roy screw-slotting and deburring machine



Zagar "In-Line" gearless drill heads



Heavy-duty open-side shaper-planer brought out by the Rockford Machine Tool Co.

ing in a straight line with the new heads reduces drilling time and fixture costs, and in some cases reduces the number of machines required. This type of "In-Line" drill heads is available in three capacities for drilling holes arranged in straight lines 13, 15, and 26 inches long, with drill sizes ranging from 1/8 to 3/4 inch in diameter.

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Palmgren Tilting Rotary Indexing Type Milling Table

The Chicago Tool & Engineering Co., Chicago, Ill., recently announced a new rotary table which incorporates a rotary feed and two cross-slides in addition to a tilting feature which enables an operator to set the table at any angle from 0 to 90 degrees in a vertical plane.

This Palmgren No. 84 tilting, rotary index milling table has an 8-inch diameter top which is graduated through 360 degrees. The center of the top plate is bored for a 1 1/2-inch locating plug. By tightening two locking screws the top can be securely held in place.

The rotary indexing dial is calibrated in 3-minute intervals, and the cross-feed dials have accurate 0.001-inch graduations. Cross-slides travel 4 1/4 inches at right angles and the cross-feed screws have 1/2-inch Acme threads.

Handwheels are removable and an indexing attachment and plates can be quickly added to the rotary feed-shaft. The worm-gear ratio is 40 to 1. The base is 9 3/4 by 5 inches with 5/8-inch keyways and keys for machine mounting.

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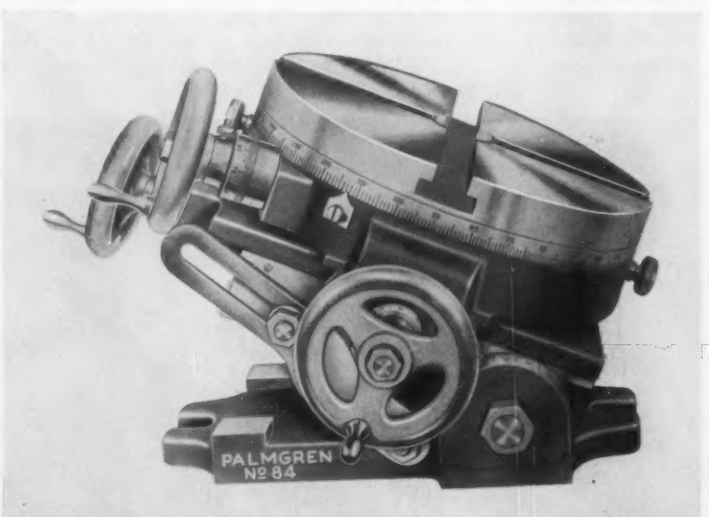
Rockford Heavy-Duty Open-Side Hydraulic Shaper-Planer

The Rockford Machine Tool Co., Rockford, Ill., has added a heavy-duty open-side hydraulically operated machine to the company's line of shaper-planers. This new machine is built in 30 by 24-, 30 by 30-, 36 by 36- and 36 by 42-inch table sizes with stroke lengths ranging from 6 to 20 feet in increments of 2 feet. It is equipped with the new hydraulic triple circuit which provides the correct combination of cutting speed and force required to machine materials ranging from free-cutting types to the toughest steels economically.

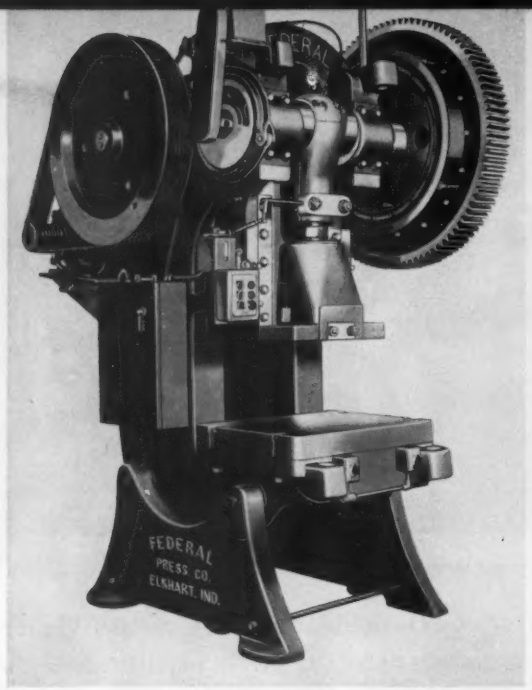
Three distinct cutting ranges are provided, including high speeds for low cutting force; medium speeds for medium cutting force; and low speeds for heavy cutting force. Infinitely variable speeds range from 10 to 300 feet per minute with maximum return speed regardless of cutting speed.

Rugged tool-heads with a vertical feed engagement facilitate operator control. The tool-head saddles, as well as the vertical feed-slides, are equipped with adjustable double nuts, eliminating backlash and simplifying setting-up for new work. All tool-heads have an inside clapper-block arrangement and a positive abutment to take the thrust of the cut. Maximum cross-feed and vertical feed of 0.500 inch to all heads facilities finish-planing.

Circle Item 130 on postcard, page 239



Rotary indexing type milling table made by Chicago Tool & Engineering Co.



Federal press with electro-pneumatically controlled air-actuated clutch

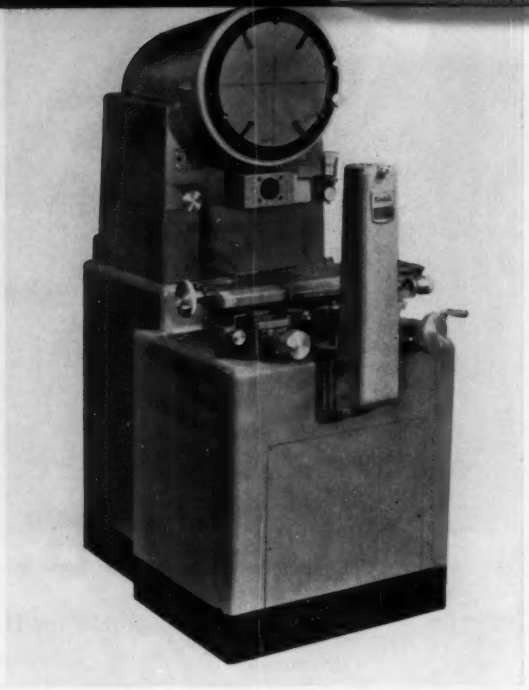


Fig. 1. Heavy-duty contour projector brought out by the Eastman Kodak Co.

Federal Press Equipped with Air Clutch

A No. 8 air-clutch press of 100-ton capacity was introduced at the Machine Tool Show by the Federal Press Co., Elkhart, Ind. The air-clutch presses of this company's line now cover a capacity range of from 6.6 to 100 tons. This press incorporates features designed to permit precision operation at higher speeds and with maximum safety. The air-actuated clutch is electro-pneumatically controlled. Twin solenoid valves are also provided to insure safe operation. A system of lights indicates safe operating conditions.

The electro-pneumatic control permits instantaneous finger tip starting and stopping. The press may be single-tripped (with either hand or foot control), "inched," or operated continuously.

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Kodak Heavy-Duty and Portable Contour Projectors

A Model 14-5 heavy-duty contour projector, Fig. 1, combining maximum table travel and a 14-inch screen, was shown for the first time at the Navy Pier Production Engineering Show by the Eastman Kodak Co., Rochester, N. Y. Also exhibited were the Kodak contour projectors Models 4, 5, 8, 30, and the 14-2A (a new version of the Model 2A). Models of a measuring stage and an angle-measuring device for the Model 8 projector, Fig. 2, were included.

Large, heavy parts unsuited to projection on smaller equipment may be handled easily on the new Model 14-5 because of its extra-large, heavy-duty work-table which enables it to withstand greater weight without measureable deviation. This work-table assembly, similar to that used on the previously-introduced Model 30, is box-like in design and is supported by a column 5 inches in diameter located in widely spaced precision bearings. Deflection is minimized by the use of outboard braces in the form of a heavy channel skirt.

A full 17.5-inch throat clearance —constant at any magnification selected—facilitates positioning large parts on the 26- by 8-inch work-table. A table travel of 8 inches is provided in both horizontal and vertical planes, and the focusing travel is 3 inches. This projector is designed to measure intricate parts to an accuracy of 0.0001 inch, or to be employed for

Fig. 2. Kodak portable, bench type contour projector

gaging by comparing the image of the part with a chart. A Kodak lens turret, activated by a handwheel, permits the choice of any of six magnifications at the turn of a knob. Once in focus, the object remains in focus when magnification is changed.

The measuring attachment is equipped with micrometers guaranteed accurate to 0.00005 inch over their entire 1-inch range. Specially selected dial indicators eliminate the need for micrometer feel. Rectangular or cylindrical measuring blocks, in standard dimensions, can be inserted in the horizontal or vertical micrometers to cover the full travel range. A filter holder on the lamp-house collimater accepts polarizing filters for strain analysis applications, or standard Kodak Wratten light filters where colored light is desired. The lamp house is blower-cooled to assure operator comfort. Overlay clips hold 10 by 12- or 11 by 14-inch overlay chart gages pressed securely in contact with the surface of the screen. Available as accessory equipment are: rotary protracting ring; Kodak lens turret, vertical beam unit; and self-contained surface illuminator.

The Kodak contour projector Model 8, shown in Fig. 2, is a portable, bench type unit which is adaptable for either horizontal or vertical projection. Used either way, it is always "right reading."

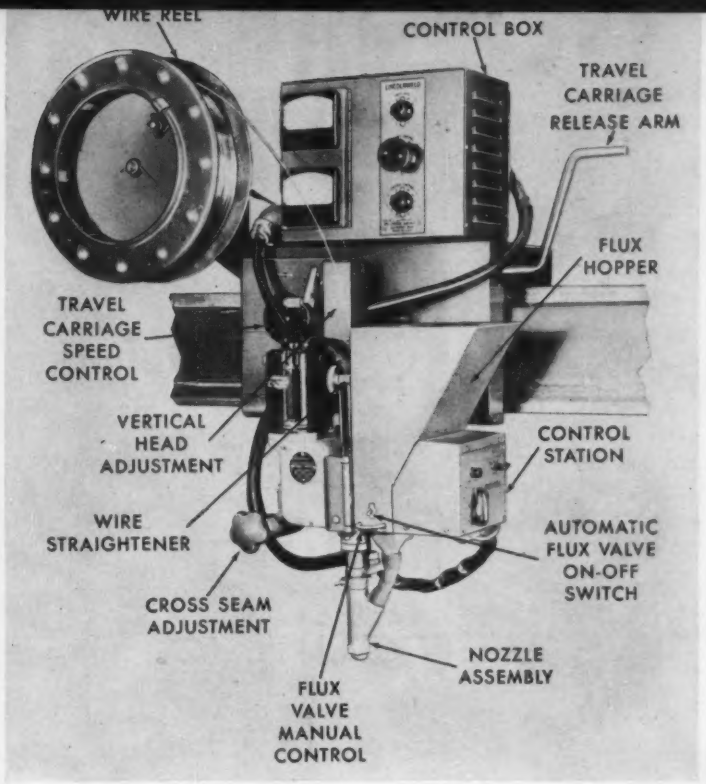
Circle Item 132 on postcard, page 239

Ex-Cell-O Broaches, Milling Cutters, and Special Tools

In addition to its line of metalworking machines displayed at the Machine Tool Show, the Ex-Cell-O Corporation, Detroit, Mich., had on exhibition an assortment of cutting tools from its Continental Tool Works.

A representative group of precision spindles covering a wide range of applications was also displayed. The company manufactures and sells spindles both as original equipment for new machines and as replacement spindles to improve the operation of used equipment. Precision railroad pins with bushings and drill-jig bushings, also manufactured by Ex-Cell-O and stocked in large quantities for fast shipment service, were shown.

Circle Item 133 on postcard, page 239



Lincoln submerged arc-welding equipment of improved design

Lincoln Submerged Arc-Welding Equipment

The Lincoln Electric Co., Cleveland, Ohio, has created a new line of equipment for hidden or submerged arc welding which includes three new welding heads, new controls, adjustments, accessories, and two new power sources. This line has been developed to give maximum flexibility to Lincolnweld automatic equipment in meeting the requirements of any job.

The welding heads, LAF-3, LAF-4, and LAF-5, offer a choice of heads for either alternating or direct current, field, or shop welding, and constant potential or variable voltage power source. New operation controls permit a choice of instantaneous starting, either hot for intermittent welding, or

(Continued on page 224)

Standard and special tools and cutters made by Continental Tool Works, Division of Ex-Cell-O Corporation

dynamic

NEW

advance

in

milling

versatility...

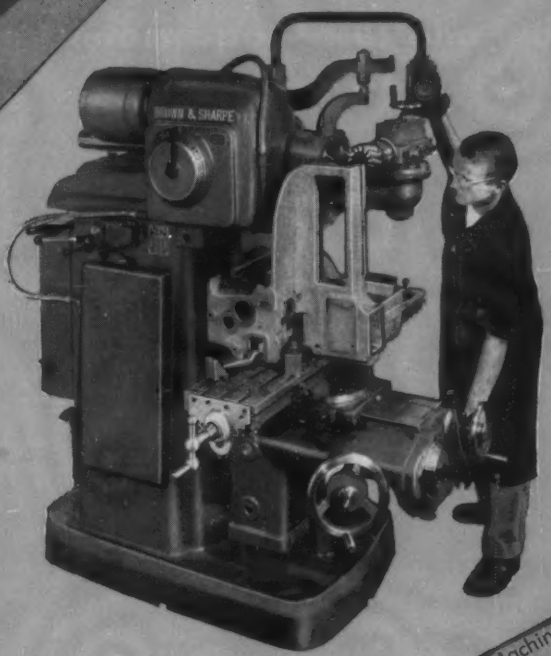
the

RANGEMASTER

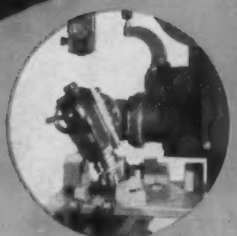
Now the new Brown & Sharpe *Rangemaster* provides work-range and milling flexibility unmatched by any other single machine! Saves tremendously on set-ups — especially for multi-surface milling jobs. Permits fast, easy changes from horizontal to vertical and angular milling. Both spindles utilize full power on all work; vertical spindle has 18 speed changes from 80 to 3060 rpm. Exclusive features: Quill feed and universal head movement give 360° range in two planes without extra attachment. Both spindles on same vertical centerline. Massive ways, 22" wide, for sliding head. Sustained high-accuracy milling in any work position! Available as universal or plain milling machine. Write for full details. Brown & Sharpe Mfg. Co., Providence 1, R. I.

RANGEMASTER'S UNIQUE RANGE

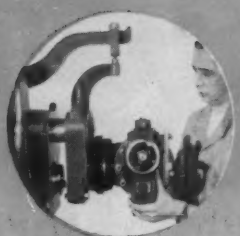
28" table travel • 12" transverse feed
22⅞" sliding head movement • 20¼" vertical feed
3½" hand movement of quill in universal head



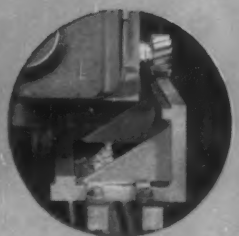
The Rangemaster (No. 20 Universal Milling Machine—sliding-head type).



Horizontal, vertical, or angular milling quickly available with full 3 h.p. at spindle.



Universal head permanently mounted on crane—swings completely out of way when not in use. Both spindles always at ideal height for fast set-up and easy operation.



Full use of table travel plus exceptional sliding head range permits milling of many multi-surface jobs with only one work set-up.

LBS

Brown & Sharpe

cold for precision starting; and a choice of variable inching speeds, either slow or fast, away from or to the work.

The heads are designed to permit easy adaptation to fixtures, either as a complete unit or as separate components. They can be universally positioned at any angle in three dimensions or off center for round-about welding.

Either welding jaws or a welding nozzle for more precise placing of flux can be used. Flux flow start or stop is controlled either automatically or manually. All controls are comparatively simple, using only rheostats, switches, and relays so that any electrician can service the equipment or adapt it to fixture controls. Field operation is possible from engine-driven welders without line power.

Electrodes in sizes from 3/32 inch to 7/32 inch are handled by one set of drive rolls which are easily accessible through a hinged door. A separate set of easily changeable rolls handles 5/64-inch diameter wire. A roller-bearing wire straightener with a single adjusting screw can be swung 360 degrees about a vertical axis to accommodate wire reels in any position.

Circle Item 134 on postcard, page 239

Allen Bench Type Open-Back Inclinable Press

A bench type 2-ton open-back inclinable punch press is announced by Alva Allen Industries, Clinton, Mo. This Model BT-2 power press is adapted for the production of small stampings and operates at a speed of 250 strokes a minute. The quick-action, single-pin clutch provides for simple, positive, non-repeat or repeat action.

Accurate ram adjustment is maintained by a simple, positive lock. The press frame can be easily tilted to any operating angle desired. An extra-large die space is provided for stamping, shearing, forming, drawing, riveting, blanking, and cutting of such materials as metal, plastics, textiles, fiber, leather, and paper.

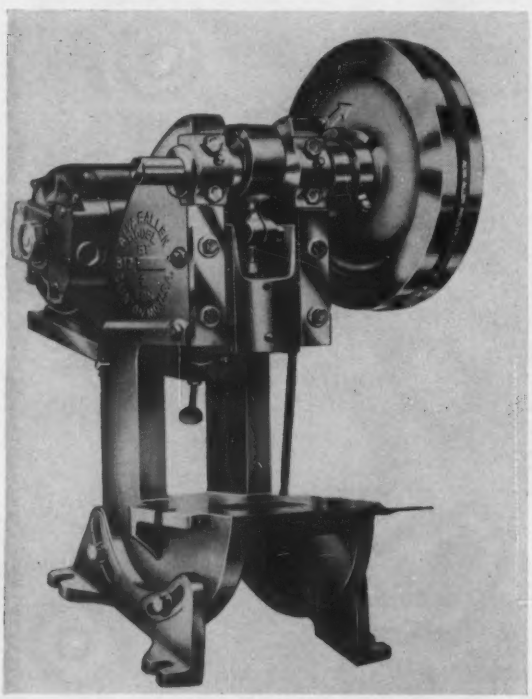
The press is of heavy-duty, precision construction, and can be used to free larger equipment for the heavier jobs. Its versatility also adapts it for use in experimental work. The press weighs 116 pounds and it has a standard stroke of 3/4 inch with 1/4- to 1/2-inch strokes optional at an additional cost. A 1/3-H.P. motor is required for the drive.

Circle Item 135 on postcard, page 239

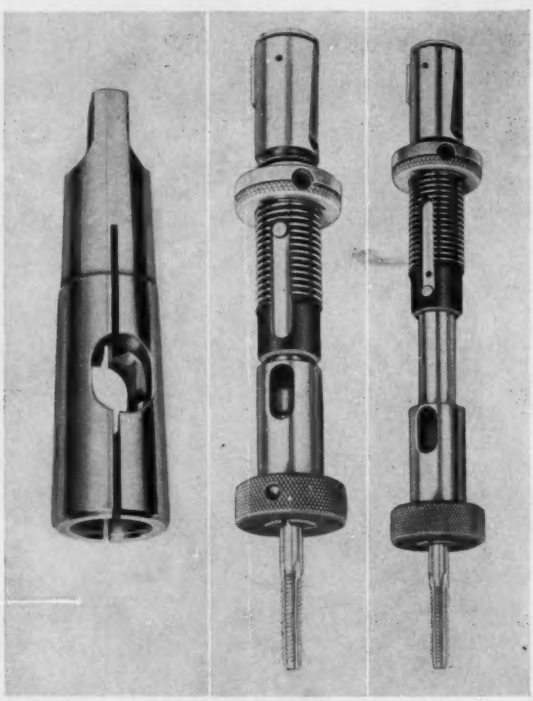
Scully-Jones Drill Driver and Tap-Holders

A new drill driver for center-drilling operations, and tension and compression tap-holders for multiple-spindle machines have been developed by Scully-Jones & Co., Chicago, Ill. The new drill driver shown at the left in the accompanying illustration is designed for accurate center-drilling operations in centering machines, drill presses, boring mills, lathes, milling machines, and automatic screw machines. This driver is of one-piece design and will drive combined center drills and countersinks of the regular or bell type. An offset splined section furnishes a positive drive in the flutes of the drill and also protects the cutting edges. The drill tip is protected in the countersunk hole back of the splined section. The driver closes evenly on the body of the drill, assuring a true running tool, and the bore and shank are concentric within 0.002 inch. Basic dimensions conform to Chrysler, Ford, and General Motors standards.

The new "JT" line of lock-and-eject collet tap-holders of the tension and compression types shown in the two views to the right



Bench type open-back inclinable press which has been announced by Alva Allen Industries



(Left) Scully-Jones drill driver. (Center) Tension tap-holder. (Right) Compression tap-holder.

ANOTHER EXAMPLE of
REDUCING COSTS WITH—

Buhr ECONOMATION

Drills, chamfers, spot-faces and individual-lead-screw taps 377 master-brake cylinders an hour gross....

and features electronic mechanism for checking broken drills!

This 7-way dial-type hydraulic-feed Buhr Special has a 48″-diameter 7-position power-operated index table, complete with shot bolt. Two parts are loaded per station in each of its seven fixtures. Automatic clamping of fixtures is performed by a power-wrench with torque control.

Electronic mechanism automatically checks two .028 drills. Following each cycle, drill-checking arms swing sensing probes to and from drills. If either drill is broken, special electronic sensing-circuit stops machine and flashes failure-light.

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HIGH PRODUCTION MACHINERY

Find out how Buhr Economation can reduce your production costs. Phone, wire or write us. A consultation with one of our top sales executives will be arranged promptly!

BUHR MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers

have been designed to compensate for variations between the feed of the spindle and the lead of the tap. They are intended primarily for use on multiple-spindle machines which take adjustable adapter shank tools.

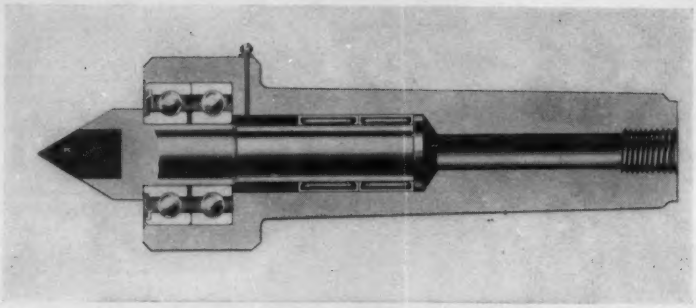
An important advantage of these holders is that they eliminate the need for lead-screws on many tapping operations. Taps of various pitches can be used without making costly feed changes on multiple-spindle tapping operations. The compression tap-holder should be used when the spindle feed is greater than the tap lead and the tension tap-holder should be employed when the spindle feed is less than the tap lead. The sensitive compression or tension spring permits the tap to follow its own lead without damaging the thread.

Each holder may be used for a wide range of sizes by merely changing the lock-and-eject tap chucks. Only seven basic assemblies are required.

Circle Item 136 on postcard, page 239

Cross Carbide-Tipped Live Center

Herbert Cross & Son, Bala-Cynwyd, Pa., are offering a new line of live centers with tungsten-carbide tips. This new design feature is said to increase the live center life from five to ten times by retaining a plus or minus 0.0001-inch accuracy far longer than previously thought possible.



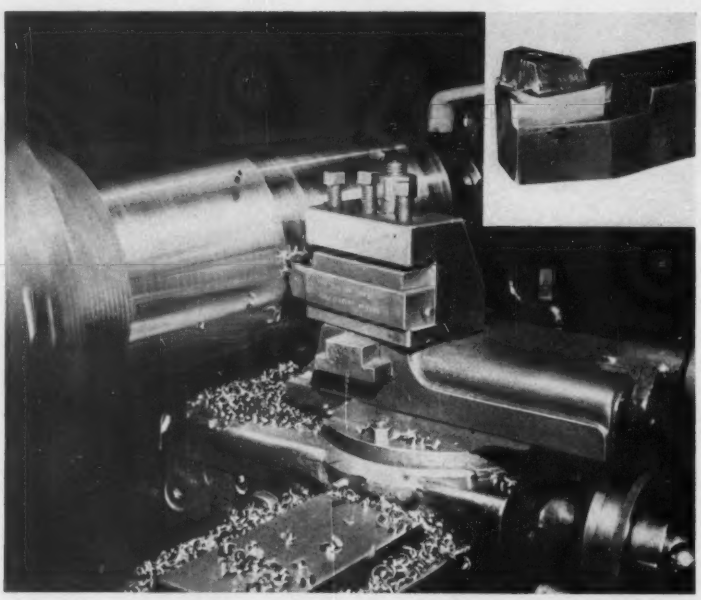
Carbide-tipped live center made by Herbert Cross & Son

The Cross center is designed expressly to withstand the higher speeds and increased pressures set up by carbide cutting tools. It is claimed that twin radial- and thrust-loaded ball bearings in the head and twin radial-loaded needle bearings in the shank increase the load capacity of the live center from two to three times and eliminate spindle deflection, chatter, and loss of accuracy. Morse taper shanks up to No. 5 and straight shanks up to 2 inches in diameter are available.

Circle Item 137 on postcard, page 239

Ceramic Tool for Metal Cutting

The Norton Co., Worcester, Mass., has announced the development of an Alundum ceramic metal-cutting tool that is said to have produced startling results in recent development tests at the Rodman laboratory of the Watertown Arsenal. These Alundum tool bits are entirely in the development stage. Made of Norton's aluminum oxide product, they are now available only in limited quantities to industry for research and machining studies.



Norton Alundum ceramic tool machining SAE 4140 steel at Rodman Laboratory on 15-H.P. 18-inch engine lathe at 1500 surface feet per minute, using feed of 0.010 inch per revolution and cutting depth of 0.250 inch.

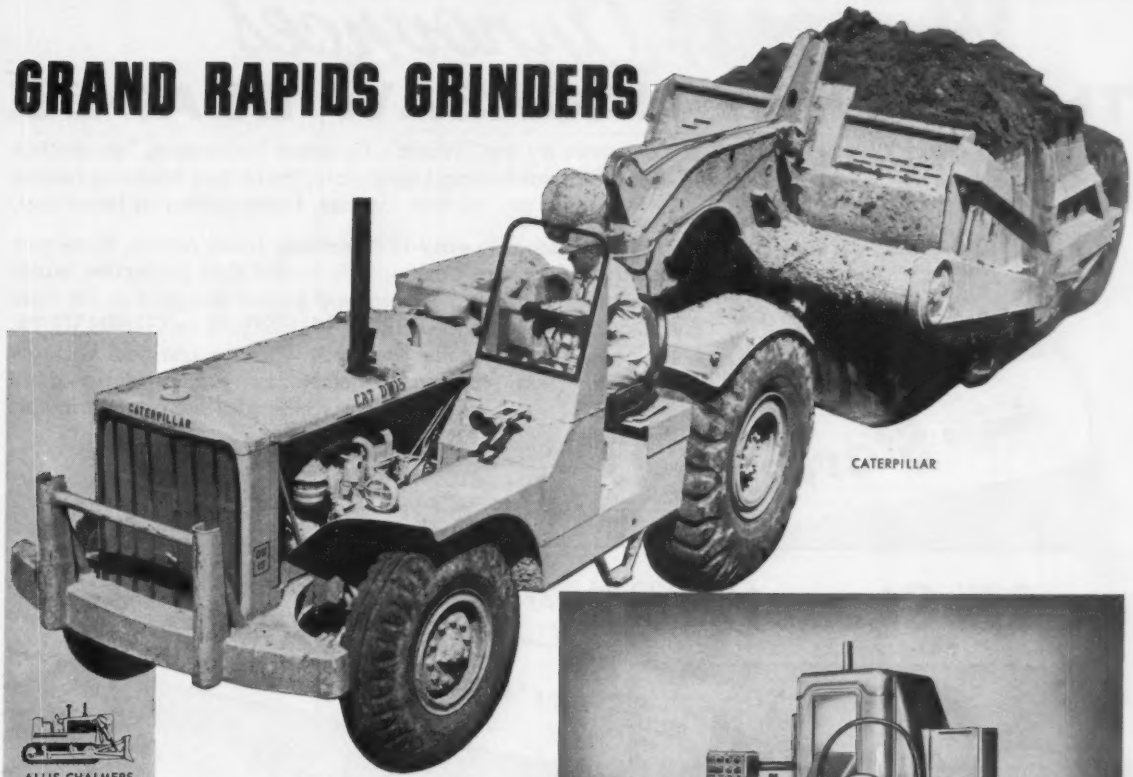
Machining tests at the Rodman laboratory on steel (SAE 1020 and SAE 4140), commercial brass and low-alloy cast iron show that the hardness, high-temperature strength, and wear-resistance properties of the Alundum cutting tools are superior to metallic tool compositions. By means of heavy, rigid tool-holders, such as developed by the Rodman laboratory, ceramic tool characteristics of lower tensile strength at room temperature plus less thermal shock resistance have been overcome. It is said that the advantages of ceramic tools can be fully realized by using solidly constructed engine lathes with high power capable of high-speed operation.

Because they could be operated at higher speeds, Norton ceramic tools are said to have cut up to three times faster in these tests than tools normally used. They have required no coolant, and produced an excellent surface finish. As more rugged machines with increased power become available, it is expected that even greater advantages will be obtained. Work-piece and cutting tool remain cool to touch when the tool

(Continued on page 232)

FOUND WHERE WORLD FAMOUS TRACTORS ARE "BORN"

GRAND RAPIDS GRINDERS



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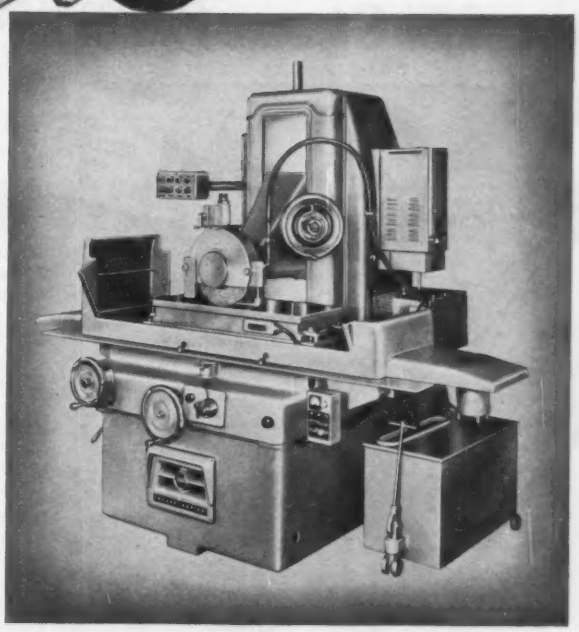
The makers of these famous tractors and allied heavy-duty equipment use Grand Rapids Grinders in their toolrooms. In fact, you'll find Grand Rapids Grinders wherever manufacturers place a premium on precision . . . because they're designed and built for lifetime precision grinding.

Take our Model 560, shown at right. Its column and base are a massive, one-piece casting for permanent, rigid alignment. Wheel head has powered rapid vertical travel; cross feed and longitudinal travel table are hydraulically actuated. Table speed is variable up to 140 fpm, making this the *fastest* grinder of its type and size!

If you're not already enjoying these standout features in your toolroom, a note on your letterhead will bring full details.



GRAND RAPIDS NO. 560 HYDRAULIC FEED SURFACE GRINDER. Table speed up to 140 fpm. Working surface of table is 14" x 36". Vertical movement of wheel head is 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1800 and 2140 rpm.

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THREE NEW HACKSAW BLADES

Precision made by the "World's Greatest Toolmakers," production proved in the Starrett Testing Laboratory, these new hacksaw blades will give you quicker, cleaner, faster cutting at lower cost.

Distinctively color-identified, with easy-to-remember trade names, these new Starrett Hacksaw Blades are packaged in heavy duty protective boxes featuring a striking new red and yellow design. Ask for them by name . . . Starrett REDSTRIPE, BLUESTRIPE or GREENSTRIPE. Choose them by color when you want the one best hacksaw blade for any cutting assignment. For prompt, dependable service, buy through your Industrial Supply Distributor.

STARRETT REDSTRIPE® SM Special Alloy High Speed Steel Power and Hand Blades. Combining the newest developments in heat treating with the hard, long-wearing qualities of special high speed steel. Specially tempered for extra toughness and high speed cutting of hard materials with heavier speeds and feeds.

STARRETT GREENSTRIPE® SAFEFLEX® Welded Edge Power Blades and Hard Edge — Flexible Back Hand Blades. Power blades are shatterproof . . . double-welded to give you the safest, straightest cutting, longest-lasting power blades ever made. Hand blades combine a hard cutting edge and tough, flexible back to make them virtually unbreakable.

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PRECISION GROUND FLAT STOCK • HACKSAWS, BAND SAWS and BAND KNIVES
THE L. S. STARRETT COMPANY, ATHOL, MASSACHUSETTS, U. S. A.

For more information on products advertised, use Inquiry Card, page 239

AMERICAN STANDARD KNURLING—9

Table 2. (*Continued*) Diagonal and Diamond Knurling Produced by Straight Tooth Cylindrical Knurls

No. of Teeth On Work	Theoretical Blank Diameter on Which Standard Pitch Knurls May be Expected to Track*																			
	Angle Between Axis of Work and Knurl Axis																			
	25 Deg.				30 Deg.				35 Deg.				40 Deg.				45 Deg.			
	64P	96P	128P	160P	64P	96P	128P	160P	64P	96P	128P	160P	64P	96P	128P	160P	64P	96P	128P	160P
49	0.845	0.563	0.422	0.338	0.884	0.589	0.442	0.354	0.935	0.622	0.467	0.374	0.990	0.666	0.500	0.400		0.722	0.541	0.433
50	0.862	0.575	0.431	0.345	0.902	0.601	0.451	0.361	0.954	0.634	0.477	0.381	1.010	0.680	0.510	0.408		0.736	0.552	0.442
51	0.879	0.586	0.440	0.352	0.920	0.613	0.460	0.368	0.973	0.647	0.486	0.389		0.693	0.520	0.416		0.751	0.563	0.451
52	0.896	0.598	0.448	0.359	0.938	0.625	0.469	0.375	0.992	0.660	0.496	0.397		0.707	0.530	0.424		0.766	0.574	0.460
53	0.914	0.609	0.457	0.365	0.956	0.637	0.478	0.382	1.010	0.672	0.505	0.404		0.721	0.541	0.432		0.781	0.586	0.468
54	0.931	0.621	0.465	0.372	0.974	0.650	0.487	0.390		0.685	0.515	0.412		0.734	0.551	0.441		0.795	0.597	0.477
55	0.948	0.632	0.474	0.379	0.992	0.662	0.496	0.397		0.698	0.525	0.420		0.748	0.561	0.449		0.810	0.608	0.486
56	0.965	0.644	0.483	0.386	1.010	0.674	0.505	0.404		0.710	0.534	0.427		0.761	0.571	0.457		0.825	0.619	0.495
57	0.983	0.655	0.491	0.393		0.686	0.514	0.411		0.723	0.544	0.435		0.775	0.581	0.465		0.839	0.630	0.504
58	1.000	0.667	0.500	0.400		0.698	0.523	0.419		0.736	0.553	0.443		0.789	0.592	0.473		0.854	0.641	0.513
59		0.678	0.509	0.407		0.710	0.532	0.426		0.749	0.563	0.450		0.802	0.602	0.481		0.869	0.652	0.521
60		0.690	0.517	0.414		0.722	0.541	0.433		0.761	0.572	0.458		0.816	0.612	0.490		0.884	0.663	0.530
61		0.701	0.526	0.421		0.734	0.550	0.440		0.774	0.582	0.465		0.829	0.622	0.498		0.898	0.674	0.539
62		0.713	0.534	0.428		0.746	0.559	0.447		0.787	0.591	0.473		0.843	0.632	0.506		0.913	0.685	0.548
63		0.724	0.543	0.434		0.758	0.568	0.455		0.799	0.601	0.481		0.857	0.643	0.514		0.928	0.696	0.557
64		0.736	0.552	0.441		0.770	0.577	0.462		0.812	0.610	0.488		0.870	0.653	0.522		0.943	0.707	0.566
65		0.747	0.560	0.448		0.782	0.586	0.469		0.825	0.620	0.496		0.884	0.663	0.530		0.957	0.718	0.575
66		0.759	0.569	0.455		0.794	0.595	0.476		0.837	0.629	0.504		0.897	0.673	0.538		0.972	0.729	0.583
67		0.770	0.578	0.462		0.806	0.604	0.484		0.850	0.639	0.511		0.911	0.683	0.547		0.987	0.740	0.592
68		0.781	0.586	0.469		0.818	0.613	0.491		0.863	0.649	0.519		0.925	0.694	0.555		1.001	0.751	0.601
69		0.793	0.595	0.476		0.830	0.622	0.498		0.875	0.658	0.526		0.938	0.704	0.563			0.762	0.610
70		0.805	0.603	0.483		0.842	0.631	0.505		0.888	0.668	0.534		0.952	0.714	0.571			0.773	0.619
71		0.816	0.612	0.490		0.854	0.640	0.512		0.901	0.677	0.542		0.965	0.724	0.579			0.784	0.628
72		0.827	0.621	0.497		0.866	0.650	0.520		0.913	0.687	0.549		0.979	0.734	0.587			0.795	0.636
73		0.839	0.629	0.503		0.878	0.659	0.527		0.926	0.696	0.557		0.993	0.744	0.596			0.807	0.645
74		0.850	0.638	0.510		0.890	0.668	0.534		0.939	0.706	0.565		1.006	0.755	0.604			0.818	0.654
75		0.862	0.647	0.517		0.902	0.677	0.541		0.951	0.715	0.572			0.765	0.612			0.829	0.663
76		0.873	0.655	0.524		0.914	0.686	0.548		0.964	0.725	0.580			0.775	0.620			0.840	0.672
77		0.885	0.664	0.531		0.926	0.695	0.556		0.977	0.734	0.587			0.785	0.628			0.851	0.681
78		0.896	0.672	0.538		0.938	0.704	0.563		0.990	0.744	0.595			0.795	0.636			0.862	0.689
79		0.908	0.681	0.545		0.950	0.713	0.570		1.002	0.753	0.603			0.806	0.645			0.873	0.698
80		0.919	0.690	0.552		0.962	0.722	0.577			0.763	0.610			0.816	0.653			0.884	0.707
81		0.931	0.698	0.559		0.974	0.731	0.585			0.773	0.618			0.826	0.661			0.895	0.716

*Modifications of these diameters may be required in order to suit various knurling conditions, such as materials and variations in practice.

Extracted from ASA B5.30-1958 with permission of publisher, American Society of Mechanical Engineers

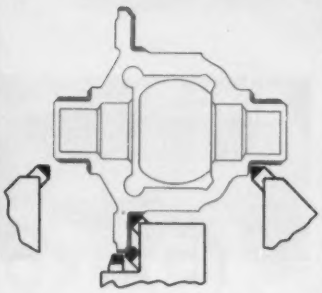
AMERICAN STANDARD KNURLING—10

Table 2. (*Continued*) Diagonal and Diamond Knurling Produced by Straight Tooth Cylindrical Knurls

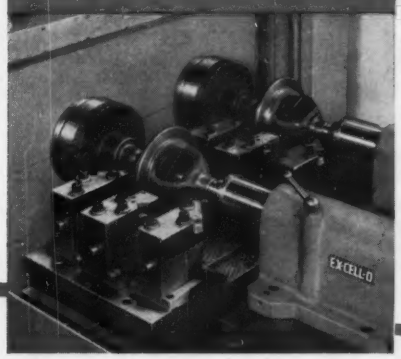
No. of Teeth On Work	Theoretical Blank Diameter on Which Standard Pitch Knurls May be Expected to Track* — Angle Between Axis of Work and Knurl Axis: 25 Deg.				30 Deg.				35 Deg.				40 Deg.				45 Deg.			
	64P	96P	128P	160P	64P	96P	128P	160P	64P	96P	128P	160P	64P	96P	128P	160P	64P	96P	128P	160P
82		0.942	0.707	0.565		0.986	0.740	0.592			0.782	0.626			0.836	0.669			0.906	0.725
83		0.954	0.715	0.572		0.998	0.749	0.599			0.792	0.633			0.846	0.677			0.916	0.734
84		0.965	0.724	0.579		1.010	0.758	0.606			0.801	0.641			0.857	0.685			0.928	0.742
85		0.977	0.733	0.586			0.767	0.613			0.811	0.649			0.867	0.694			0.939	0.751
86		0.988	0.741	0.593			0.776	0.621			0.820	0.656			0.877	0.702			0.950	0.760
87		1.000	0.750	0.600			0.785	0.628			0.830	0.664			0.887	0.710			0.961	0.769
88			0.759	0.607			0.794	0.635			0.839	0.671			0.897	0.718			0.972	0.778
89			0.767	0.614			0.803	0.642			0.849	0.679			0.908	0.726			0.983	0.787
90			0.776	0.621			0.812	0.650			0.858	0.687			0.918	0.734			0.994	0.795
91			0.784	0.628			0.821	0.657			0.868	0.694			0.928	0.742			1.005	0.804
92			0.793	0.634			0.830	0.664			0.877	0.702			0.938	0.751				0.813
93			0.802	0.641			0.839	0.671			0.887	0.710			0.948	0.759				0.822
94			0.810	0.648			0.848	0.678			0.897	0.717			0.959	0.767				0.831
95			0.819	0.655			0.857	0.686			0.906	0.725			0.969	0.775				0.840
96			0.828	0.662			0.866	0.693			0.916	0.732			0.979	0.783				0.849
97			0.836	0.669			0.875	0.700			0.925	0.740			0.989	0.791				0.857
98			0.845	0.676			0.884	0.707			0.935	0.748			0.999	0.800				0.866
99			0.853	0.683			0.893	0.714			0.944	0.755			1.009	0.808				0.875
100			0.862	0.690			0.902	0.722			0.954	0.763				0.816				0.884
101			0.871	0.697			0.911	0.729			0.963	0.771				0.824				0.893
102			0.879	0.703			0.920	0.736			0.973	0.778				0.832				0.902
103			0.888	0.710			0.929	0.743			0.982	0.786				0.840				0.910
104			0.896	0.717			0.938	0.751			0.992	0.794				0.849				0.919
105			0.905	0.724			0.947	0.758			1.001	0.801				0.857				0.928
106			0.914	0.731			0.956	0.765				0.809				0.865				0.937
107			0.922	0.738			0.965	0.772				0.816				0.873				0.946
108			0.931	0.745			0.974	0.779				0.824				0.881				0.955
109			0.940	0.752			0.983	0.787				0.832				0.889				0.963
110			0.948	0.759			0.992	0.794				0.839				0.897				0.972
111			0.957	0.765			1.001	0.801				0.847				0.906				0.981
112			0.965	0.772				0.808				0.855				0.914				0.990
113			0.974	0.779				0.815				0.862				0.922				0.999
114			0.983	0.786				0.823				0.870				0.930				1.007

*Modifications of these diameters may be required in order to suit various knurling conditions, such as materials and variations in practice.

Extracted from ASA B5.30-1953 with permission of publisher, American Society of Mechanical Engineers



Heavy lines show the surfaces machined.



Style 112-D Ex-Cell-O Precision Boring Machine with double set-up.

Close-up of the two differential cases, in work position. This precision work is done with hydraulic feeds and easily-controlled automatic cycles.

Insure your Profits...

with DOUBLED PRODUCTION on Ex-Cell-O STANDARD MACHINES

XLO
EX-CELL-O for PRECISION

A NEW APPROACH . . . Turn four diameters—face three shoulders—chamfer one edge. Not one at a time—but *Two!* Not on a double end—but on a single end Ex-Cell-O Precision Boring Machine!

Workpieces are automotive differential cases—precision work—limits of plus or minus .0005" on diameters.

See how Precision Boring Machines can save time and money for you. Call your local Ex-Cell-O representative, or phone or write Ex-Cell-O for a Precision Boring Catalog.

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EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS of PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

and chip-breaker are properly applied. Because of the remarkable heat resistance of the ceramic tool, blanks can be shaped by dry grinding with diamond wheels. Resharpening is easily done on the same metal-bonded diamond wheel used for sharpening carbide tools.

Circle Item 138 on postcard, page 239

Presses for Piercing and Trimming Plastics

A line of hydraulic presses developed for trimming and piercing parts made from vacuum-formed plastic has been announced by the Dake Corporation, Grand Haven, Mich. These presses are designed to provide operating speeds which match those of the forming equipment.

Features include fast ram approach for time-saving closure and return of the movable platen, adjustable stroke control for automatic slow-down before work is contacted, and accurate pressure for maximum job flexibility. All-steel construction and guided platens assure the rigidity and alignment necessary for accurate work.

There are five standard models available in capacities from 75 to 300 tons, with platens ranging from 40 by 50 inches to 60 by 80 inches, and daylight opening from 22 to 40 inches.

Circle Item 139 on postcard, page 239

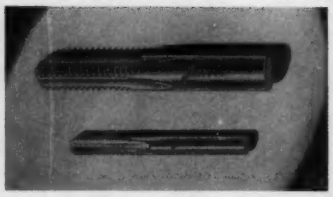
Geni Tool-Holders and Adapters

The Universal Engineering Co., Frankenmuth, Mich., has brought out a line of Geni tool-holders and adapters which is said to cut the time required for changing tools from minutes to fractions of seconds. With these holders and adapters there is no need to stop the machine spindle in order to change tools.

The Geni holder is of simple construction. It consists of a combination body and shank, a locking ring, two steel balls and retaining rings. Operation is also simple, a light push with the thumb raises the locking ring and releases the adapter. The next adapter is then inserted in the holder and the locking ring allowed to drop in place. This securely locks the balls in the adapter slots and provides a positive drive.

The holders and adapters are self-centering. As cutting pressure is applied, the taper of the adapter is seated accurately in the mating taper of the holder. In many applications the accuracy of the Geni holders makes it possible to drill and ream the holes without the use of a pilot bushing. All parts are carefully heat-treated and precision-ground to insure long life and accuracy.

Circle Item 140 on postcard, page 239

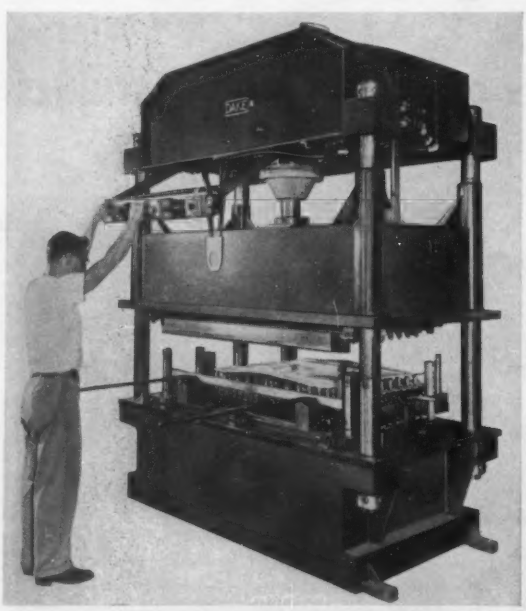


Stub taps of line introduced by the Jarvis Corporation

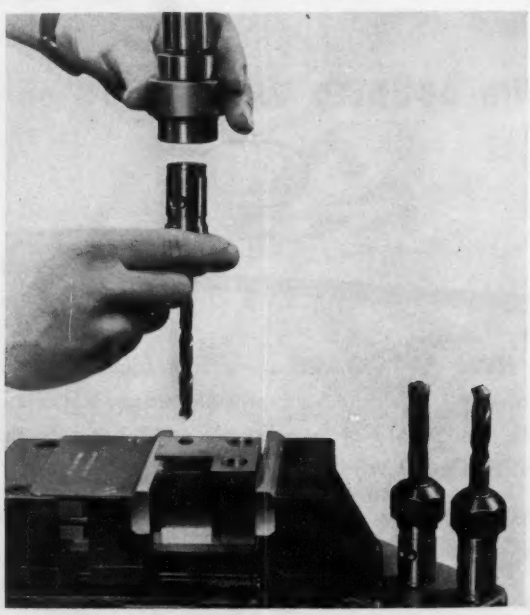
Jarvis Stub Taps for Automatic Screw and Bar Machines

A standard line of stub taps with conventional fractional size shanks for use in automatic screw and bar machines is now available from the Jarvis Corporation, Middletown, Conn. These taps are designed for tapping operations performed on bar automatics which require a tap that is shorter than the standard length. They are made in numbered and fractional sizes ranging from No. 4 to 1/2 inch and can be furnished at no extra cost in right-hand plug and bottoming styles, ground for tapping specific materials. Special surface treatments have been developed which can be employed to increase wear resistance and prevent galling to meet special tapping applications.

Circle Item 141 on postcard, page 239



Plastics piercing and trimming press placed on the market by the Dake Corporation



Geni tool-holders and adapters manufactured by the Universal Engineering Co.

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Extruded Shapes give HUBER 5 GREAT ADVANTAGES

—they can do as much for you

This is the story of a Brazing Torch valve body, made by Huber Industries, Cincinnati 38, Ohio, chiefly out of a brass extruded shape furnished by Revere. As a result of experience Huber has become an outspoken advocate of shapes. Here are the five advantages Huber has found:

1. Machining time reduced 50%.
2. Uniform dimensions mean only one machine set-up for each operation.
3. No rejects whatever. Testing completely eliminated.
4. Uniformity of metal means minimum wear on tools.
5. Buy slugs cut to length, eliminating cutting-off.

The only part of this valve not of brass is the stainless steel conical valve stem.

An extruded shape costs more per pound than standard rod or bar, but the reductions in machining, finishing and other costs much more than make up the difference, and you save money. If you are machining copper and copper-base alloys, or aluminum alloys, get in touch with Revere and learn the advantages of extruded shapes.

Progressive steps in producing valve, beginning with the shape as supplied, cut to length.

Huber Type 100, Model A Brazing Torch.

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Founded by Paul Revere in 1801

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Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

"The Revere Four-Way Service" is a 16mm sound motion picture in color, educational and informative. If you haven't seen it, write nearest Revere Office.

Subland drill which is being manufactured by Chicago-Latrobe

Chicago-Latrobe "Subland" Drills

Chicago-Latrobe, Chicago, Ill., is making to order special "Subland" drills which have separate sections or margins of two or more diameters that extend the full length of the flutes. These drills are used where it is desired to perform two or more operations in one pass of the tool. The two margins may be so ground that they can be employed to drill and countersink for flat-head machine screws; or to drill and counterbore for socket-head screws; or to drill and form a single- or double-radii counterbored hole. Subland drills with two or more diameters are most extensively applied on high-production jobs, where they are used to machine holes of various diameters and with angular- or radii-formed shoulders. Drills for producing holes with as many as four steps of different diameters are being manufactured.

To obtain the best results with this drill, the difference between the smallest and largest diameter should not be too great because of the variation in cutting speeds and feeds. Also the largest diameter should not be more than twice as large as the smallest diameter. Drills with a diameter of less than 3/16 inch are not recommended.

Circle Item 142 on postcard, page 239

Elox Line-Voltage Regulator

The Elox Corporation, Clawson, Mich., has introduced an automatic line-voltage regulator designed to meet the increased demands for the control of electrical energy for precision machinery. This regulator maintains a 220-volt source of power and holds output voltage within limits of plus or minus 1/2 per cent. The regulator can be set for any output between 210 and 240 volts for variations of the input line voltage between 195 and 280 volts. This regulator is designed to handle up to 8 1/2-K.V.A. loads at output currents of 22 amperes. The correction rate is approximately 20 volts per second.

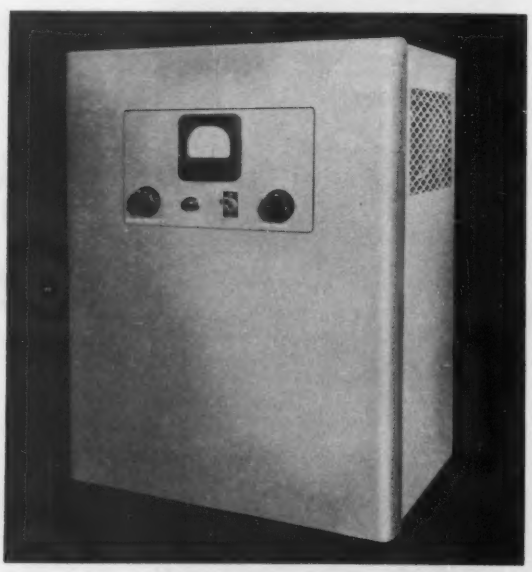
Circle Item 143 on postcard, page 239

Combination Drilling, Reaming, Chamfering, and Tapping Head

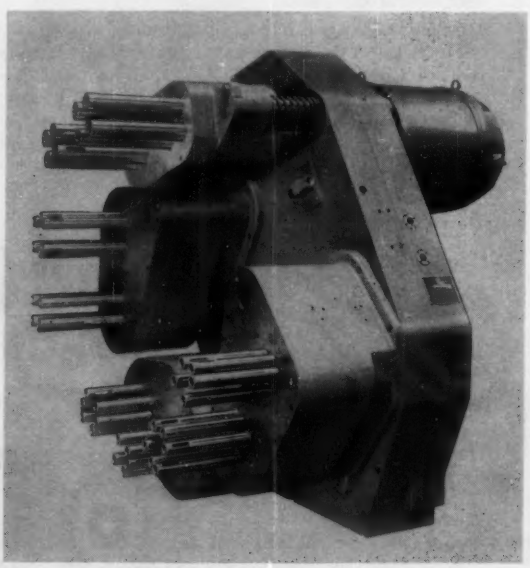
The United States Drill Head Co., Cincinnati, Ohio, has recently designed and built a special forty-one-spindle drilling, chamfering, reaming and tapping head for use in a machine tool manufacturing plant. The master drive-box of this head operates in a horizontal position and is mounted on a hydraulic slide. Four multiple-spindle pot heads are mounted on the drive-box head as shown in the illustration. Three of the pot heads have eleven spindles each. One of these heads is equipped for drilling, one for chamfering, and the third for reaming. The fourth head has eight individual lead-screw spindles for tapping 1/2–20 holes in the work processed with this equipment.

The three drilling, chamfering, and reaming heads are driven from the master drive-box by a 15-H.P. motor through a flexible coupling. The motor is mounted on the hydraulic slide.

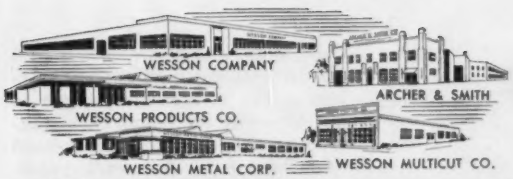
This combination head operates in conjunction with a five-station trunnion type fixture. Bushing plates used with the three pot heads for drilling, chamfering, and reaming, however, are not shown. Brackets bolted and doweled to the front face of each pot head carry these bushing plates. The total height of the



Line-voltage regulator for controlling precision machinery made by Elox Corporation



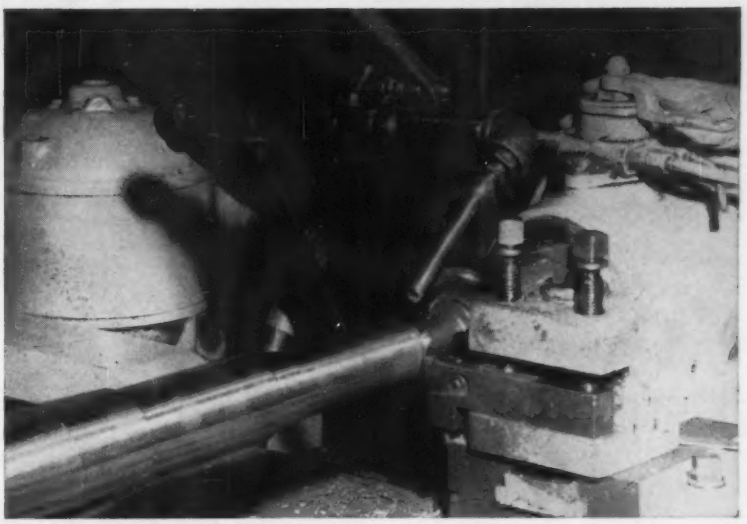
Multiple-spindle head for drilling, chamfering, and tapping built by the United States Drill Head Co.



carbide NEWS

26 Outperforms Other Carbides 8:1

Boosts sprocket shaft output from 15 to 120 pieces per grind



In a series of production comparison tests, Grade 26 again came out on top—this time in machining forged steel (Rockwell 44) tractor sprocket shafts at a large midwestern tractor company.

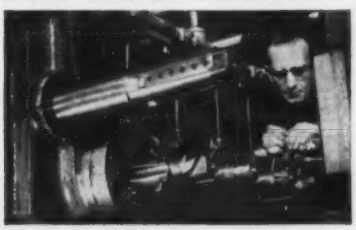
With Wessonmetal 26, output averaged 120 pieces per grind as compared with 15 pieces per grind for all other steel cutting grades tested.

The operation is performed on a new 20" Monarch Air Gage Tracer lathe and consists of finish turning the shaft diameter, forming radii and chamfers, and rough turning all other diameters. Length of travel in the cut is 18¼"; speed 375 sfpm; feed range from .009 to .012". Average depth of cut for all diameters is ¼-inch.

Primary reason for the big increase in life achieved with Wessonmetal 26 is its ability to stand up under widely varying conditions. Inserts made of other carbides shattered or broke after 12 to 15 pieces on one cutting edge and could not be indexed. This trouble was eliminated with Grade 26, which averaged 20 pieces per edge and could be indexed to give a total of 120 pieces per grind.

Worthy of note also is that the performance of Wessonmetal 26 (a "nearly universal" steel cutting grade) was achieved in comparison even with carbides of a specialized nature specifically selected for this operation.

New Film Points Way To Better Tooling



One of the most dramatic technical sound films yet produced is now released by the Wesson Company for showings to technical and shop groups.

Built around the development of tooling for an actual job—the machining of tractor track links—the 16 mm. technicolor sound film—which took two years to complete—records the *failures* as well as the successes achieved. The trials and tribulations encountered will remind many of their own experiences.

Entitled "Tools of Abundance," the film tells how a large manufacturing committee working with Wesson tool engineers carried a specific job through to completion. It is the story of how cooperation helps to develop and improve American manufacturing methods.

This story of teamwork—supplemented by about a dozen other general machining and high production operations in the film—provides a rational approach to solving other difficult tooling problems. For a showing to YOUR company, write for the film on your company letterhead. A Wesson man will bring it to you.

Tool Hints

If you have an idea that you would like to get better tool life on a job than you are getting, do these things and you may find you were right:

1. Check for vibration and chatter and eliminate all you can. Both are deadly to tool life.

2. Check whether the rake angles are correctly ground. There is a best combination for any job.

3. Check whether you have the ideal combination of speed and feed.

4. Check whether tools are changed before they get too dull. Dull tools wear faster than sharp ones. Keeping them at work is false economy.

5. Check tool after each sharpening against the tool PRINT. This is excellent insurance.

None of these suggestions are new. But they are still keys to better tool performance.

(P.S.—A sixth method is to call in a Wesson man)

Wesson tools Wessonmetal carbide

WESSON COMPANY
DEPT. AD
1220 Woodward Heights Blvd.
Detroit 20, Michigan

head is 49 inches and the total width is 42 1/2 inches.

A special 7 1/2-H.P. motor with a speed of 900 R.P.M. drives the lead-screw pot head. This ball-bearing equipped motor is totally enclosed, fan-cooled, has special insulation and is designed for reversing duty.

Circle Item 144 on postcard, page 239

Ingersoll-Rand Electric "Impactool"

A size 4U-SD electric "Impactool," designated as a standard duty model for applications where maximum power and speed are not required, is being manufactured

Standard duty model "Impactool" made by Ingersoll-Rand Co.

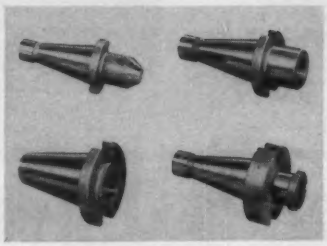
by the Ingersoll-Rand Co., New York City. The impact mechanism and all other construction features are similar to the recently announced heavy-duty size 5U "Impactool" which, pound for pound, is said to provide the highest power of any 1/2-inch drive electrically operated impact tool.

Due to its lower power, the new 4U-SD "Impactool" is both smaller and lighter in weight than the size 5U but like the latter is a multiple-purpose tool and readily adaptable to drilling, reaming, tapping, screw-driving, wire brushing, and similar operations.

Circle Item 145 on postcard, page 239

Tool-Holders and Adapters

Recent additions to the line of tool-holders made by the Universal Engineering Co., Frankenmuth, Mich., include both single and double end-mill adapters, tang-drive tapered-socket adapters, draw-bar tapered-socket adapters, and shell end-mill arbors. These new holders are precision made from carefully selected steels and permit work to be held to unusually close tolerances.



Tool-holders announced by the Universal Engineering Co.

Circle Item 146 on postcard, page 239

"Unipunch" Line of Punch Press Units

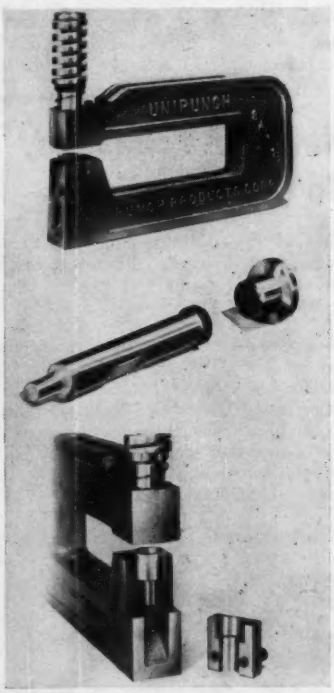
A new line of unitized perforating units has been introduced by the Punch Products Corporation, Niagara Falls, N. Y. These units, bearing the trade name "Unipunch," embody many features developed to facilitate the handling of a wide range of work in the metal fabrication field. Series "A" units, shown in the upper view of the accompanying illustration, have a maximum capacity for piercing 1/4-inch mild steel and are available in holder widths of from 1 inch to 2 1/2 inches, giving a perforating range from 0.093 inch to 1.500 inches. The narrow holder and top-mounted stripping spring permit close hole-to-hole spacing.

An outstanding feature of these units is the two-piece punch and the small button die developed to obtain a substantial reduction in the cost of replacement parts. The central view of this illustration shows the two-piece punch which makes it possible to slide the punch-head off the punch body so that only the tool steel punch body need be replaced. The bottom view shows the small button die, which is held firmly in the die pedestal of the holder and which can be replaced without removing the holder from the set-up.

An important advantage claimed for unitized tooling is that it permits re-use of the units in different combinations. This principle of use and re-use serves to reduce tooling costs. The punch guide is free-floating in the upper arm of the holder which serves only to maintain the punch and die in concentric alignment. Actually, the stripping pressure is developed by the heavy spring interposed between the punch-head and the top of the punch guide. The bottom of the punch guide transfers this stripping pressure directly to the work-piece.

Another basic feature embodied in each "Unipunch" unit is a mounting pilot-pin which is concentric with the center line of the punch and die. This pilot-pin is made 3/8 inch in diameter regardless of the size of the punch or die or whether the punch be round or shaped. To produce a hole pattern by mounting "Unipunch" units on templates it is only necessary that the pattern be laid out and drilled with a series of 3/8-inch holes. Units having punches of the shape and size required for each hole drilled in the template are then mounted in their correct positions by inserting their 3/8-inch pilot-pins in the pre-drilled pattern holes and tightening the hold-down screws to secure the units to the template. The units can also be mounted on T-slotted plates in flat bed presses.

Circle Item 147 on postcard, page 239



"Unipunch" Series "A" unit, two-piece punch, and button die introduced by Punch Products Corporation

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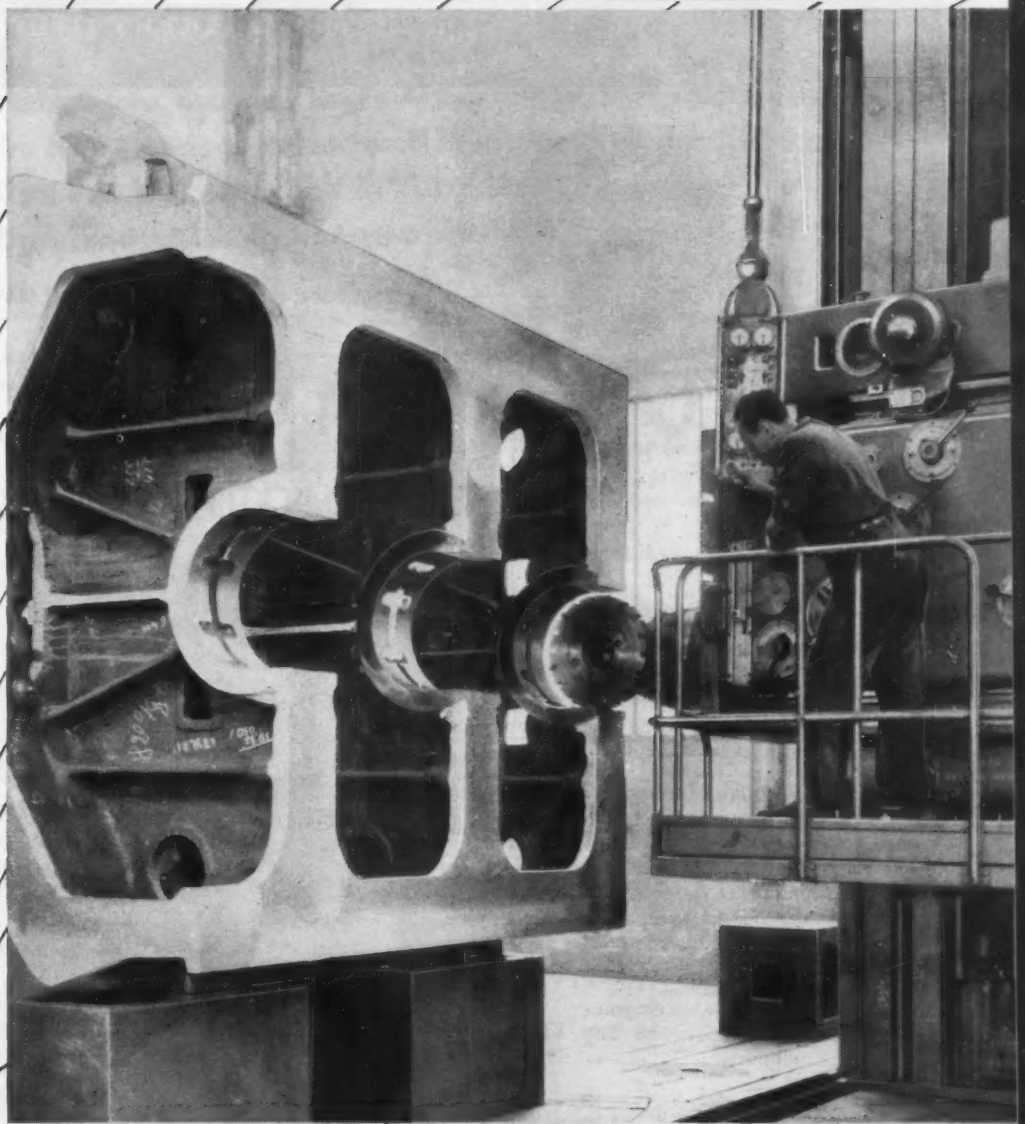

Milling of the side faces and faces of the uprights, as well as boring of the bearings in one setting of a Diesel motor bed plate on a:

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Type FAF 305-200

Power available at the milling cutter:
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For more information on products advertised, use Inquiry Card, page 239

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Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On products mentioned in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

GEAR-SHAVING MACHINES—National Broach & Machine Co., Detroit, Mich. Bulletin AP55-8, containing 16 pages on representative models in the company's line of Red Ring gear-shaving machines, gear inspection equipment, gear lapping machines, gear grinding machines, self-contained broaching fixtures, and broaches. First 10 pages describe new machines and equipment exhibited at the Machine Tool Show in Chicago. These include external gear-shaving machines equipped for automatic and semiautomatic loading, internal and external gear speeders and nick testers, internal gear shavers, automatic gear gaging and sorting machines, gear checkers and rolling fixtures, and self-contained broaching fixtures. 1

LATHE CALCULATOR—Cincinnati Lathe & Tool Co., Cincinnati, Ohio. A turning calculator which aids the selection of lathe feeds and spindle speeds for most rapid turning and helps determine the most economical cutting speed. One side of the calculator, labeled "Lathe Set-Up Calculator," is used to determine the fastest feeds and speeds for tool-room operations, job-lot turning, or initial production runs. The other side of the calculator, labeled "Economic Cutting Speed," provides an answer to the question, "How economically can I cut?" on high production operation. The calculators are available for $1 each, complete with instruction booklet. It is recommended that payment accompany request. 2

GEAR CLASSIFIERS—Michigan Tool Co., Detroit, Mich. Bulletin 355, describing and picturing the operation and design of the company's three-way gear classifiers. Step-by-step action of the machines which automatically monitor over size, under size, and correct size is explained. The bulletin also describes the three-way classifier controller and variations of the classifier which are adapted for continuous belt conveying of wide-face and cluster gears, as well as monitoring of gear properties other than over size and under size. 3

DRILL UNITS—Morris Machine Tool Co., Cincinnati, Ohio. Bulletin 92, containing 12 pages on Cam-Matic drill units for automatically controlled tapping, drilling, reaming, chamfering, spot-facing, hollow milling, centering, and honing. Complete data covering two models and including three types of drive arrangements and three possible mounting positions. A special section permits the reader to trace, through numerical reference, the operational action of the unit on drilling and tapping operations, including the movement of mechanical components, and the energizing of electrical circuits. 4

HOLES, CONTOURS, AND SURFACES—Moore Special Tool Co., Inc., Bridgeport, Conn. 4-page folder describing the contents of a 424-page book entitled "Holes, Contours and Surfaces: Located, Machined, Ground and Inspected by Precision Methods." The leaflet contains a listing of the subjects covered in the book's fourteen chapters and special Woodworth circular tables section. There are typical examples of the more than 450 close-up photographs and working drawings. Complete price information and a handy ordering coupon is also included. 5

VIBRATION MOUNTINGS—T. R. Finn & Co., Inc., Industrial Division, Hawthorne, N. J. Catalogue FP-55, containing 4 pages on a new line of vibration mountings for medium and heavy weight machinery. The mountings known as FINN-FLEX "Floating Pillows" vibration mountings are said to offer a degree of vibration, shock, and overload control previously unobtainable in a single mounting. A detailed description is given on the construction, load capacities, and frequencies. Illustrations of typical installations, and the company's engineering services are described. 6

ELECTRIC HEAT-TREATING FURNACES AND OVENS—Cooley Electric Mfg. Corporation, Indianapolis, Ind. Catalogue E-4, giving complete description, dimensions, specifications, temperatures, and control information on general-purpose electric furnaces, high-speed electric furnaces, recirculating furnaces, electric ovens, and industrial box furnaces. Also included is information on the new Models GA-3 and GA-4, the first of a new series of controlled atmosphere tool-room furnaces which can be used for operations to 2000 degrees F. 7

DEBURRING AND CHAMFERING—Modern Industrial Engineering Co., Detroit, Mich. Bulletin 103-103, describing the BMI-55 Burr-Master for production deburring and chamfering of internal gears and splines. Discussed in the 2-page bulletin are features of the machines including circular type form tools, rapid changeable tooling that is put to work without requiring trial cuts or adjustment after being put in place, the simplified operating cycle, and design features that guarantee long life and trouble-free operations. 8

SILICONES—Linde Air Products Co., Division of Union Carbide and Carbon Corporation, New York City. 4-page catalogue listing the company's various silicones, in liquid and solid forms, in the broad categories of water repellents; oils, and oil emulsions; electrical insulating resins; silicone rubber gum stock and compounds; and silicones which make excellent anti-spatter and anti-foaming materials. In addition there are descriptions of silicone intermediates and silicone monomers. 9

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DIAL INDICATORS AND GAGES—L. S. Starret Co., Athol, Mass. Bulletin 416, containing 80 pages on the company's line of dial indicators, gages, and instruments. It includes 140 models of the high-precision, low-friction test indicators, magnetic-base holders, comparators, bench gages, depth gages, hand and pocket gages, dial sheet gages, cylinder gages, out-of-roundness gages, inside dial gages, strain gages, and vibrometers. **10**

FORGED WELDLESS STEEL RINGS AND FLANGES—Standard Steel Works Division, Baldwin-Lima-Hamilton Corporation, Burnham, Pa. 12-page booklet discussing design advantages and cost-cutting applications of the forgings in industrial processing equipment and machinery. Steps in the manufacture of the rings and flanges made by the company are also traced. These include production of high-quality steel, mandrel forging, roll forging, heat-treating, and machining. **11**

STANDARD AND SPECIAL GAGES—Freeland Gauge Co., Detroit, Mich. 8-page brochure illustrating and describing a broad variety of standard and special gages and measurement control methods, gaging devices, fixtures, and precision size control instruments are illustrated. Selected at random, these illustrations of air-gage application exemplify the company's solutions to a variety of close-tolerance manufacturing problems. . . **12**

GEAR-GRINDING MACHINES — Gear Grinding Machine Co., Detroit, Mich. 8-page brochure giving complete information on a newly developed line of fully automatic gear-grinding machines. Data is included on six automatic features, as well as five additional features which insure increased quality and production of gears. Photographs and descriptions of the complete line of machines available are presented. **13**

GAGING MACHINES—Pratt & Whitney Co., Inc., West Hartford, Conn. Circular 592, containing 12 pages on multi-dimension Sigmatic gaging machines for production gaging problems. These machines are assembled from standard units and conversion for other gaging needs is simple and economical. Construction features are given and dimensions and illustrations are also included. . . . **14**

PRECISION TOOLING—Scully-Jones & Co., Chicago, Ill. Bulletin 6-50, containing 8 pages of information on some of the precision tools available for multiple-spindle machines. Various applications are described for quick-lock adjustable adapter assemblies and bodies, quick-lock nuts, spindle extension assemblies, and Toolitrol bores and gages. Dimensions of standard tools are included. **15**

ELECTRONIC CONTROLS — Dynamatic Division, Eaton Mfg. Co., Kenosha, Wis. Bulletin EC-1, containing 16 pages of information on the installation, performance, and maintenance of the basic Dynamatic electronic control. The leaflet is complete with illustrations and circuit diagrams. Precise control in addition to many other features which provide individual control requirements are presented. **16**

SURFACE GRINDERS—Mattison Machine Works, Rockford, Ill. Booklet telling the story of the new combination way and surface grinder which makes possible the grinding of large bed castings, columns, tables, slides, saddles, and heads faster to precision tolerances without expensive re-handling. There is a description of the three-column box type construction which assures maximum stock removal and fine finish. **17**

FLEXIBLE MECHANICAL COUPLINGS—Philadelphia Gear Works, Inc., Philadelphia, Pa. 12-page catalogue on flexible gear type mechanical couplings. This reference booklet tabulates complete dimensions and specifications in size numbers up to 6 inch nominal bore for each type of coupling. Data also covers horsepower load, and ratings for each size and type of coupling at 100 R.P.M. Dimensional drawings are included. **18**

LABORATORY METAL-TREATING UNIT—Ipsen Industries, Inc., Rockford, Ill. Bulletin RT-10, describing the new laboratory metal-treating unit, RT-25-E. It is the first time a laboratory unit has been designed to accurately and completely duplicate large furnace operations on a laboratory level. The bulletin fully describes the various features of the unit and gives pertinent specifications. . . . **19**

INDUSTRIAL HYDRAULICS MANUAL—Vickers Incorporated, Detroit, Mich. Publication containing 14 pages devoted primarily to operation and maintenance of the company's equipment. The equipment covered is limited to the representative services most commonly encountered in the machine tool industry. Data is also included on basic hydraulics, and all types of pumps, motors, and controls. **20**

MILLING MACHINES—Cincinnati Milling Machine Co., Cincinnati, Ohio. Publication M-1915, describing the company's dial type milling machine, including Nos. 2, 3, and 4 plain, universal, and vertical. Highlights of design, features, index to operating controls, dimensional drawings, general specifications, and equipment supplied at extra cost are also presented. **21**

CHIPLESS MACHINING MACHINES—Michigan Tool Co., Detroit, Mich. Bulletin RF-55, covering in 8 pages the complete line of Roto-Flo "chipless machining" machines for cold-forming of toothed parts. The booklet in addition to covering the three standard sizes of machines now available, shows numerous examples of Roto-Flo machines in action, producing toothed parts of various types. **22**

CARBIDE INSERTS AND BLANKS—Kennametal, Inc., Latrobe, Pa. Brochure B112, giving information on helical inserts for milling cutters, together with spiral fluid blanks for end-mills, reamers, and drills. The leaflet describes straight-gash and uniform-section helical inserts, as well as solid and bushing type helical shapes. The solid and bushing shapes are for cutters less than 2 inches in diameter. **23**

MAGNETIC PULLEY—Stearns Magnetic, Inc., Milwaukee, Wis. Bulletin 303-C, containing 6 pages describing a new simplified pulley selection method with detailed specifications on the company's magnetic pulleys and pulley separators. A simplified selection method is also given which makes it easy for the user to accurately select the right size pulley for his application. **24**

Product Information Service

Use postage-free Business Reply Card below for further information concerning New Catalogues described in this issue and products mentioned in the editorial pages or advertisements.

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FILTERS—Cuno Engineering Corporation, Meriden, Conn. Catalogue SAK-057, containing 4 pages on the company's Super Auto-Klean filter which can remove particles down to 40 microns and smaller from liquids with an all-metal, two-stage-edge type, continuously cleanable filter. Included are a description of how Auto-Klean works, flow rates, and available housings. 25

SURFACE BROACHING MACHINE—Colonial Broach & Machine Co., Detroit, Mich. Bulletin VCA-55, giving details and features of the Colonial continuous broaching machine which has a stroke length of 154 inches. The bulletin covers construction, operation, controls, and specifications. The machine is a new approach to high-speed surface broaching. 26

VARIABLE SPEED TRANSMISSIONS—Sterling Electric Motors, Inc., Los Angeles, Calif. 8-page leaflet describing the company's Speed-Trol variable speed transmissions. Also featured is information on factors in drive selection and a description of the many types of automatic and remote speed control accessories available. 27

AIR FILTERS—A. Schrader's Son, Brooklyn, N. Y. Bulletin containing information on the company's air-line filters, lubricators, and air-pressure regulators; with information on a special unit called the Lub-air-ator, which is easily maintained, has no moving parts, and can be serviced without disturbing pipe connections. 28

CONTROLLED AIR-POWER DEVICES—Bellows Co., Akron, Ohio. Bulletin ML-3, containing illustrations and descriptions of the company's air motor and its interchangeable valves, and also describing such items as drill press speeds, vises, hydro checks, rotary feed and index-tables, self-contained drilling units, and valves and cylinders. 29

DRILL, REAMER, AND TAP CHUCKS—Scully-Jones & Co., Chicago, Ill. Bulletin 1-50, containing 8 pages describing a newly designed line of drill, reamer, and tap chucks. Information is given on the four-slot design which increases resistance to pull-out and provides greater protection against breakage. Complete sizes and dimensions are given. 30

TOOL-HOLDERS AND MILLING CUTTERS—Viking Tool Co., Shelton, Conn. 44-page catalogue covering the company's tool-holders and milling cutters, including carbide and high-speed steel cutters. The tool-holders described feature a patented Viking chip-control block with a fully adjustable chip-breaker. 31

MILLING CUTTERS—National Twist Drill & Tool Co., Rochester, Mich. Catalogue 18-C, containing 48 pages giving complete listings of milling cutters, counterbores, end-mills, and hobs. This net price catalogue contains two new listings. They are two types of counterbores for aircraft and light metals. ..32

AUTOMATIC SCREW MACHINE—Gear Grinding Machine Co., Detroit, Mich. 6-page folder describing the "unit-construction" principle of the Screwmatic 750, single-spindle, automatic screw machine. Other advantages of the machine, as well as standard equipment and capacities are presented. 33

PYROMETERS — Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill. Bulletin F 7259, containing 11 pages of services tips for pyrometer users, including what to do if instrument is registering erratic; if instrument reading is too high, or too low. Instrument temperature curve-off is also discussed. 34

BORON CARBIDE—Norton Co., Worcester, Mass. 16-page booklet entitled "Handbook on Boron Carbide and Elemental Boron" providing information on materials made by the company for use in the atomic energy field. The subjects include a discussion of commercial boron, boron carbide, and others. 35

TRANSFER MACHINE—Sahlin Engineering Co., Inc., Birmingham, Mich. Bulletin describing a transfer machine which moves large sheet metal panels between presses automatically. The operation of the machine, which will either transfer or turn over and transfer panels, is explained in schematic drawings. 36

TOOL-HOLDERS—Carboloy Department of General Electric Co., Detroit, Mich. Publication GT-293, containing 8 pages, outlining features of the tool-holders for "throw-away" carbide inserts. Seven styles currently manufactured by the company are illustrated and technical data on fifty-two sizes is offered. ...37

MILLING MACHINES—Axelson Mfg. Co., Division of U. S. Industries, Inc., Los Angeles, Calif. Bulletin illustrating and describing the new Axelson models 10R ram-turret vertical milling machine and 10RH ram-turret duplex milling machine. The models feature large machine capacity and "all-angle" work. 38

FORGING HAMMERS—C. C. Bradley & Son, Cortland, N. Y. Catalogue 155, containing 18 pages on essential information on four types of hammers—cushioned helve, upright helve, upright strap, and compact. Illustrations, specifications and descriptions are also given. 39

FORGING FACILITIES—Wyman-Gordon Co., Worcester, Mass. Booklet describing the heavy press program of the company with forging facilities consisting of 18,000-, 35,000-, and 50,000-ton heavy presses. Statistics, illustrations, and de-

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velopment of forging techniques are included. 40

JIG-BORING MACHINES—Homestrand, Inc., Larchmont, N. Y. 7-page illustrated data sheet describing in detail types SJ and SJB ASEA jig-boring machines. Information includes a general description, specifications, and detailed drawings of available accessories. 41

PRODUCT DATA SHEET—Reynolds Metals Co., Louisville, Ky. 2-page data sheet Form C4-5-755 with a detailed technical description listing advantages and examining typical applications of the company's Activated Alumina which is a compound of aluminum and oxygen. .42

STEEL SHELVING—Borroughs Mfg. Co., Kalamazoo, Mich. 32-page catalogue describing the company's Unitized flexi steel shelving. Construction and installation features are given and detailed information on how to plan a steel shelving lay-out. 43

VACUUM MELTING—Utica Drop Forge & Tool Corporation, Utica, N. Y. 8-page booklet on the vacuum melting process. It is of interest to those concerned with metallurgy and product design. The leaflet aids in solving critical metallurgical problems. 44

HYDRAULIC TRANSMISSION—Gerotor May Corporation, Baltimore, Md. Catalogue T-100, containing 4 pages on the company's new variable-speed hydraulic transmission and giving information on control applications, performance, and dimensions. 45

FORGINGS—National Forge & Ordnance Co., Irvine, Warren Co., Pa. Leaflet giving product examples of different forgings produced by the company for industry. A caption describes each forging and its use. Photos are included. ...46

OPTICAL TOOLING—Farrand Optical Co., Inc., New York City. Catalogue describing optical tooling instruments and accessories for checking and alignment of machines. Many new items not preavailable are included. 47

DRESSING TOOLS—Diamonds & Tools, Inc., Detroit, Mich. Form DT-55, 4-page catalogue, describing the company's line of Colmonoy set diamond tools for specialized grinding wheel dressing operations. 48

AUTOMATIC TURRET LATHE—Potter & Johnston Co., Pawtucket, R. I. Bulletin 159, giving illustrations of the company's automatic turret lathe, including headstock spindle, control drum, cross-slide, control panel, and tooling. Typical applications are also shown, and standard specifications are given. 49

PNEUMATIC REGULATORS—Conoflow Corporation, Philadelphia, Pa. Bulletin H-2, containing 8 pages and listing the complete line of precision-made pneumatic regular equipment. Filter regulator combinations, relays, purge assemblies, and control panels are included. 50

CAN MACHINERY—E. W. Bliss Co., New York City. 20-page catalogue covering the company's line of flanging, beading, and thread-rolling machinery for medium and high-production can making. Design and construction features of all machines are described, and dimensions are listed. 51

FACE-MILLING GRINDING MACHINES—Oliver Instrument Co., Adrian, Mich. 12-page bulletin showing the company's line of face-milling grinding machines and giving specifications, construction features, and applications. Illustrations are included. 52

SINTERING FURNACES—Drever Co., Bethayres, Pa. Bulletin B-101, containing 12 pages of information on furnaces for sintering powder metal products and the reduction of metallic oxide. Specifications and illustrations are included. 53

PRE-SET SPEED PRESS DRIVES—General Electric Co., Schenectady, N. Y. Bulletin GEA-5702, emphasizing the versatility of the new AC pre-set speed press drives and including a selector chart for a wide variety of applications. 54

DIVIDING HEAD—Custom-Scientific Instruments, Inc., Kearny, N. J. Leaflet describing Model CS-65, which answers the need for a small dividing head. Diagrams, specifications, and illustrations are included. 55

FINANCING PLAN FOR INTERNAL GRINDERS—Bryant Chucking Grinder Co., Springfield, Vt. New folder describing various financing plans available to purchasers of the company's internal grinders and precision boring machines. 56

SHEET AND STRIP STEEL—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Bulletin 20-1, entitled "Buyer's Guide to Sheets and Strip," containing 8 pages listing more than twenty different kinds of flat rolled steel furnished in coils, stock sizes, and cut-to-order blanks. 57

LATHES—Lodge & Shipley Co., Cincinnati, Ohio. Bulletin Chip Tips #60 describing the company's new Powerturn lathes. Features which provide for greater accuracy in seventeen new models are given. 58

COMPOUND ANGLE SWIVEL VISE—Combination Vise & Jig Co., Inc., Orfordville, Wis. Leaflet describing the uses of the universal compound angle swivel vise with illustrations and applications. 59

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Between Grinds

By E. S. Salichs

A Bubbling Account

In this age of automation, it was somewhat of a surprise to read about a joggling process performed by French workers in making champagne. They walk along miles of racks which loosely hold the bottles of wine, giving each bottle a quick joggle and leaving it with a chalk mark a quarter of a turn to the side. This operation is repeated at intervals until the chalk splash has made a full circle. The effect of this process is to cause all the sediment to settle on the cork.

Misbehavin' Metal

When floods swept into magnesium powder plants in New York and Connecticut not so long ago, the action of water on the volatile magnesium powder created spectacular fires. The Magnesium Association was quick to explain in the press, however, that magnesium has a Dr. Jekyll and Mr. Hyde character, and that although Mr. Hyde won out in this instance, the beneficent Jekyll qualities far outweigh the bad Hyde traits.

Wading Through Waste

During a five-week inventory at Minneapolis-Honeywell, an order went through to set aside wastepaper baskets and throw waste on the floor, to be sorted carefully each evening. Although more than 250,000 inventory tickets poured into the cost accounting department in this period, not one was lost. But what did the gum chewers do?

Dear Louie:

(From Granger Davenport, chief engineer of Gould & Eberhardt, Inc., to Louis D. Martin, at Eastman Kodak Co.) "Thanks to MACHINERY, your talk on 'Gearing Gobbledygook' has been recorded for posterity. . . . This talk was very timely, and will do much good." August was the month, 168 the page.

Instant Parts

The Weaver Tractor Co., a Caterpillar dealer in Sacramento, Calif., recently installed radio equipment in its four stores in order to quickly locate parts for customers.

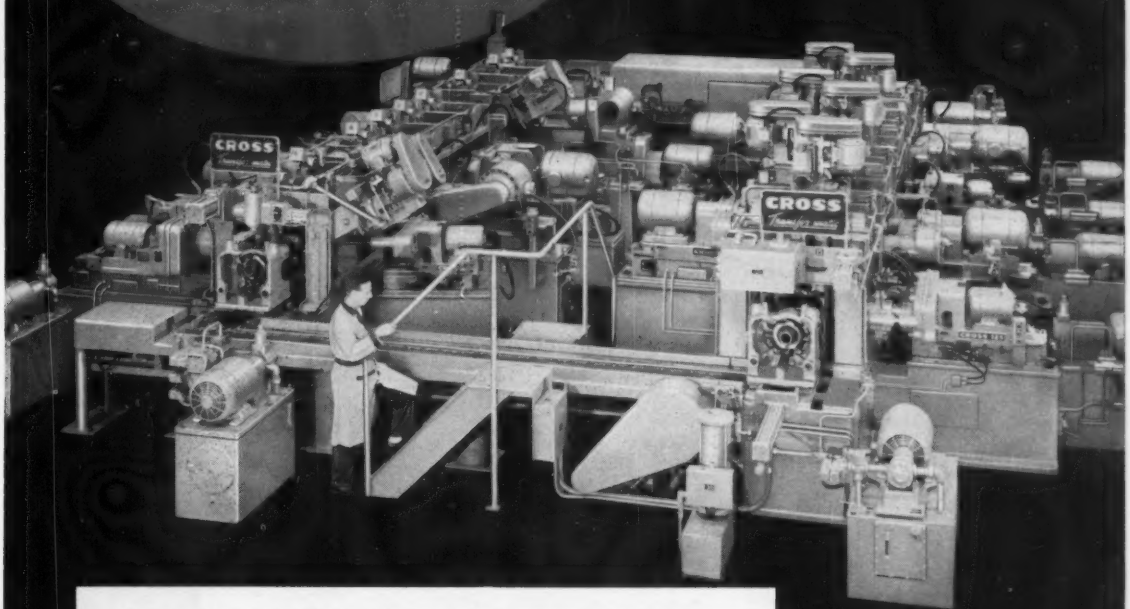
Jet Digestion

On the Vickers Viscount, the new commercial turbo-jet which the Capital Airlines flies from New York to Washington in forty-five minutes, canapes are served. Not even time for a regulation sandwich.

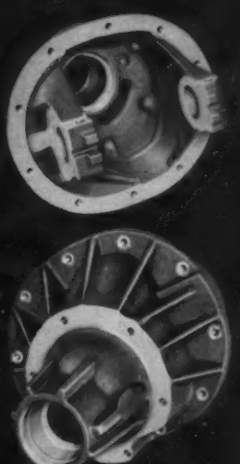
WHAT HAPPENS when a photographer (Pete Autio) on his way to a routine job meets a pretty girl (Diann Shanahan)? The assignment was to get a picture of some of the material being used in refurbishing the Engineering Building at North American Aviation, Inc., Los Angeles, Calif. Somehow, wherever Pete aimed his camera, Diann seemed right in the middle of things. So this is the picture he turned in.

Mills, Drills, Bores, Turns Differential Gear Carriers

Another Transfer-matic by Cross



- ★ Rough and semi-finish bores pinion bores and cross bores; rough and finish faces and turns pilot diameter of torque tube flange; mills faces of cross bore bosses; spotfaces flange mounting holes; drills, chamfers, reams and taps all other holes except flange holes.
- ★ 115 pieces per hour at 100% efficiency.
- ★ 73 operations: 8 milling, 8 boring, 2 crossfacing, 1 turning, 18 drilling, 10 spotfacing, 7 chamfering, 2 reaming, 9 tapping, 8 probing.
- ★ Complete interchangeability of all standard and special parts for easy maintenance.
- ★ Palletized work holding fixtures with hydraulically operated torque wrenches for clamping and unclamping parts.
- ★ Washing and drying unit for cleaning fixtures between last cutting station and loading station.
- ★ Other features: Construction to J.I.C. standards; hardened and ground ways; hydraulic feed and rapid traverse; automatic lubrication system.



Established 1898

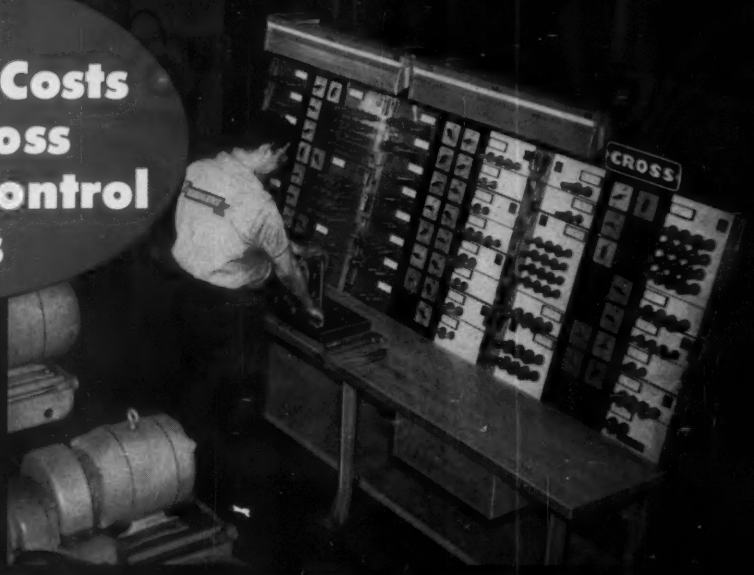
THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

A Mechanical Eye . . .

Ford Cuts Tool Costs with Cross Machine Control Units



One of the Cross Machine Control Units at Ford Motor Company's Cleveland Engine Plant

(U. S. Patent Nos. 2679038 and D-163935. Others pending).

According to records, 221 Cross Machine Control Units in operation at Ford Motor Company Plants are assisting them greatly in improving tool trouble conditions.

One reason for this is that the Machine Control Unit provides a definite and convenient place for storing tools . . . tools which are pre-set so they can be placed in operation immediately without making machine adjustments.

Another reason is that the Cross Toolometer, an integral part of the Machine Control Unit, provides a standard for the performance of the tools, thereby enabling corrective action to be taken when necessary. The Toolometer dial is set to indicate the number of pieces which a given tool should produce. When the dial has reached that pre-determined figure, the machine automatically shuts down and the tools are changed. At the same time, other tools indicated by the Toolometer as approaching the end of their usefulness are also changed to take full advantage of the machine shut down.

The Cross Machine Control Unit is helping to keep Ford production going and is also assisting greatly in controlling tool life.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS . . .

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News OF THE INDUSTRY

Alabama, North Carolina and West Virginia

RIVETT LATHE & GRINDER, INC., Boston, Mass., has announced the appointment of Benedict Engineering & Sales Co., 2115 Eighth Ave., S., Birmingham, Ala., as sales representative in Alabama, Mississippi, and northwest Florida.

CONE-DRIVE GEARS, Division of Michigan Tool Co., Detroit, Mich., has appointed the CROSS SALES & ENGINEERING CO., Greensboro, N. C., sales representative to cover the states of North Carolina, South Carolina, Virginia, and West Virginia.

BALDWIN SUPPLY CO., Charleston, W. Va., has been made Carboloy carbide distributor by the Carboloy Department of General Electric Co., Detroit, Mich. The newly appointed organization has its headquarters at 207 Virginia St., W.

California

INDUSTRIAL TECTONICS, INC., Ann Arbor, Mich., has purchased the manufacturing facilities of the ANTI-FRICTION BEARINGS CO., Los Angeles, Calif. The newly acquired plant is operating as a western division of Industrial Tectonics, Inc. but continues in business as an individually owned sales company.

ROCKWELL MFG. CO., Pittsburgh, Pa., is beginning construction of a 100,000-square-foot warehouse, assembly, and repair plant at Porterville, Calif. The plant is expected to be completed by early 1956 and will cost approximately $1,000,000.

SIDNEY W. WRAY, formerly sales engineer with the Wallace Barnes Division of Associated Spring Corporation, Bristol, Conn., has been transferred to that company's Seaboard Coil Spring Division, Gardena, Calif.

STEPHEN V. SWIATEK has been promoted to national sales and advertising manager by the Diamond Machine Tool Co., Pico, Calif. He has had twenty years' experience in the machine tool field.

Illinois

VIRGIL B. BULLEN has been named engineering representative for the Tocco Division of the Ohio Crankshaft Co., Cleveland, Ohio. He will have his headquarters at the company's Chicago, Ill., office and will cover western Illinois, Missouri, Arkansas, Nebraska, Kansas, and Oklahoma. He was formerly with the Cincinnati Milling Machine Co.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announces the following changes: MERLE A. MILLER has been appointed vice-president and treasurer, and RAYMOND N. CARLEN has been elected a vice-president. At the Cleveland, Ohio, plant, HOMER E. RIEKER has been made manager of sales; in the Tubular Products and Cold-Fnished Bar Division, WILLIAM B. HAWK has become manager of sales and EDWARD J. RICHARDSON, manager; JOHN V. BURLEY, JR., has been named field representative in the Columbus, Ohio, area. At the Chicago, Ill., plant, ROBERT A. DAGGIT has been appointed assistant manager of sales, having been succeeded by ROBERT T. MACGILL as field representative at the Detroit, Mich., plant, HAROLD E. STAVERS has been made sales manager. At the Jersey City, N. J., plant, HENRY B. WILLIAMS has been named manager of sales for the New York area, and WILLIAM K. UNDERHILL, who was formerly responsible for sales management, will devote himself to other executive duties. At the Boston, Mass., plant, ALLEN P. BECKLOFF has been promoted to manager, succeeding PARK SANDERSON, who has retired from active duty.

Jack E. Garnhart, manager Chicago district sales office, E. W. Bliss Co.

E. W. BLISS, Canton, Ohio has announced the appointment of JACK E. GARNHART as Chicago, Ill., district sales manager. Mr. Garnhart was formerly manager in the Wisconsin area. WILLIAM J. STASKO has been made sales engineer in Chicago.

ROY H. KALLAS has been appointed to the newly created post of general manager of the Grieve-Hendry Co., Inc., Chicago, Ill.

(Left) Merle A. Miller, vice-president and treasurer; (right) Raymond N. Carlen, vice-president, of Joseph T. Ryerson & Son, Inc.

E. J. SOMERVILLE, Chicago, Ill., has been appointed manufacturers' representative in the Illinois and Wisconsin area by the Horton Chuck Division of E. Horton & Son Co., Windsor Locks, Conn.

Michigan

J. S. GILLESPIE, formerly manager of product planning, has been appointed manager of the newly organized Diamond Project Section of Carboloy Department of General Electric Co., Detroit, Mich. In his new assignment, Mr. Gillespie will be responsible for transforming the laboratory techniques of making man-made industrial diamonds, which have been developed by the company's Research Laboratory, into practical production methods.

INDUSTRIAL TECTONICS, INC., Ann Arbor, Mich., has appointed KENNETH W. MCKENZIE sales manager. Mr. McKenzie is taking over the promotional activities handled by HELMUT F. STERN, who is now general manager. GERALD L. BUHRMAN has been appointed plant manager.

DETROIT REAMER & TOOL CO., Detroit, Mich., has moved into its new plant and offices located at 780 W. Maple Road, Birmingham, Mich. The total floor space of these new facilities approximates 14,000 square feet.

N. P. SYNNESTVETD has been named plant manager of the Manistee Iron Works, Manistee, Mich., a division of the Michigan Tool Co., Detroit, Mich. J. G. MAURER has been made shop superintendent. Mr. Synnestvedt has been with the company for twenty years and his responsibilities have included supervision of all purchasing activities.

N. P. Synnestvedt, manager of Manistee Iron Works, division of Michigan Tool Co.

(Left) George F. Holland, chairman of the board, Union Twist Drill Co.; (right) Stanley L. Holland, president

BEAVER TOOL & ENGINEERING CORPORATION, Royal Oak, Mich., announces the following appointments: DELMAR LANDEN has been made vice-president in charge of sales; CLEMENT RATKE has been made vice-president in charge of engineering; and WILBUR WEISE has been made assistant vice-president of sales.

GEAR GRINDING MACHINE CO., Detroit, Mich., has announced the completion of a plant addition at the company providing a 33 per cent increase in floor space. The highly modern masonry and steel building will enable the company to fill increasing orders for both screw and gear-grinding machines.

THEODORE L. THEODORFF has been appointed district sales manager for the Detroit, Mich., office of the Hamilton Press Division, Hamilton, Ohio. He has been associated with the company for the past seventeen years in various supervisory capacities of press sales and service.

A. MILNE & CO., New York City, announces the opening of a tool steel warehouse at 4820 Wabash Ave., Detroit, Mich. W. TED NAGORSEN has been named manager.

New England

BLACK DIAMOND SAW & MACHINE WORKS, INC., Natick, Mass., has acquired the stock and manufacturing rights of the Worcester drill grinder that was developed at the Worcester Polytechnic Institute and manufactured by them in the Washburn Shops, Worcester, Mass.

GEORGE F. HOLLAND, president, was named chairman of the board of Union Twist Drill Co., Athol, Mass. STANLEY L. HOLLAND, general manager of the Butterfield Division, was named president. SIMON MACKAY was re-elected vice-president; JOHN C. MOLINAR was named vice-president in charge of sales; ROSSITER HOLT was made vice-president and general manager of the S. W. Card plant; JOHN ENGELSTED was made vice-president in charge of production of the Union Twist Drill plant; and WILLIAM E. LOY was re-elected treasurer.

EDWARD BLAKE CO., INC., 437 Cherry St., West Newton, Mass., has been appointed sales representative by the Black Diamond Saw & Machine Works, Inc., Natick, Mass.

FRANCIS T. THORLEY has been appointed assistant sales manager of the Hy-Pro Tool Co., tap manufacturers, New Bedford, Mass.

PAUL N. STANTON has been appointed assistant sales manager of the Lapointe Machine Tool Co., Hudson, Mass.

NILES-BEMENT-POND CO., West Hartford, Conn., who recently merged with PENN-TEXAS CORPORATION, has had its business assets transferred to a newly formed corporation to be known as PRATT & WHITNEY CO., INC., a subsidiary of Penn-Texas Corporation. The officers of the new corporation are: L. D. SILBERSTEIN, chairman of the board; ALEXANDER H. D'ARCAMBAL, president and general manager; ERNEST STROHEIM, vice-president of finances; ALEXANDER S. KELLER, vice-president and general sales manager; DAVID R. ANDERSON, controller; LOUIS REISS, treasurer, SEYMOUR M. HEILBRON, secretary; RICHARD W. BANFIELD, vice-president and manager of Small Tool and Gage Divisions; and in the Machine Tool Division, A. L. KNAPP, vice-president and manager, and JACOB J. JAEGER, vice-president and chief engineer.

Sets NEW PRODUCTION STANDARDS for Vertical Boring and Turning Work...

46" MACHINE ILLUSTRATED—
with Turret, Ram, and
Side Head

—

Wide variety of head
combinations available

the All New KING

These new King® machines — *completely redesigned* — will bring to boring mill users the *greatest productive capacity ever achieved for vertical boring and turning work!*

Greater horsepower; increased speeds and feeds; simplified controls; many power-operated devices—will *increase your productivity.*

Advanced engineering of mountings for spindle and for all heads and turrets—substantially increased machine rigidity —will give you *greater-than-ever accuracy.*

With maximum use of *unit* construction and many components redesigned to reduce wear, you'll have a minimum of machine maintenance and downtime.

For full details on new model King machines send for new Catalog K-5 covering 30", 36", and 46" sizes. (Catalogs on larger sizes will be available later.) Write to us direct or to the King distributor in your area.

Here are a few of the many advanced KING features....

- 40 to 50 H.P. on 30" to 46" sizes.
- 75 to 100 H.P. on sizes 56" and up.
- 24 feeds available.
- Feed selection from direct-reading dial.
- 24 speeds in geometric progression in any of three standard ranges.
- Pendant-located control of:
  - pre-selective speeds from direct reading dial.
  - speed change.
  - head movements in either feed or rapid traverse.
  - power swiveling of rail heads at rapid traverse or feed rate.
  - power indexing of rail head turret and side head tool block (optional).
- Automatic lubrication of all moving parts.

AMERICAN STEEL FOUNDRIES, KING MACHINE TOOL DIVISION
1150 Tennessee Ave., Cincinnati 29, Ohio

KING Vertical Boring and Turning Machines

(Left) Albert L. Knapp, vice-president and manager of the Machine Tool Division, Pratt & Whitney Co., Inc.; (right) Jacob J. Jaeger, vice-president and chief engineer

POTTER & JOHNSTON Co., Pawtucket, R. I., will become a direct subsidiary of Pratt & Whitney Co., Inc., with EDWARD P. GILLANE as president and general manager; J. POTTER CUNNINGHAM, vice-president of sales; ERNEST STROHEIM, vice-president of finances; WILFRED J. PENDER, vice-president and factory manager; LOUIS REISS, treasurer; and SEYMOUR M. HEILBORN, secretary.

FAFNIR BEARING Co., New Britain, Conn., has begun construction of a 160,000-square-foot, single-story, machining and heat-treating plant on a 100-acre site at Newington, Conn. The new building has been scheduled for completion during the last half of 1956.

BARNABUS P. TOTH has been named sales engineer of the Hamilton Mfg. Co., New Haven, Conn., which recently acquired the manufacturing rights and inventory of the Barnaby Tool Division of the Barnaby Mfg. Co., Bridgeport, Conn.

New York and New Jersey

JAMES C. MABE, JR., has been appointed manager of plant operations for the Chicago Pneumatic Tool Co., New York City, with headquarters at the home office. All manufacturing and engineering operations in the company's domestic plants at Utica, N. Y.; Franklin, Pa.; Fort Worth, Tex.; and Garfield, N. J.; will fall under his jurisdiction.

J. L. CRANWELL, vice-president of the Pennsylvania Railroad Co., New York City, was elected president of the American Standards Association, New York City. He will fill the post left vacant by the death of EDWARD T. GUSHEE.

SHELDON V. CLARKE has been appointed manager of the general purchasing department, Union Carbide and Carbon Corporation, New York City. He succeeds H. V. HUFFARD, who is retiring after forty years of service.

JEROME F. FERDINAND has been appointed sales manager of the Punch Products Corporation, Niagara Falls, N. Y. He is located at the general offices of the company at 3800 Highland Ave., Niagara Falls.

FRANK E. SULLIVAN has been promoted to the position of chief engineer of industrial processes for the De Laval Separator Co., Poughkeepsie, N. Y. He has been with the company since 1950.

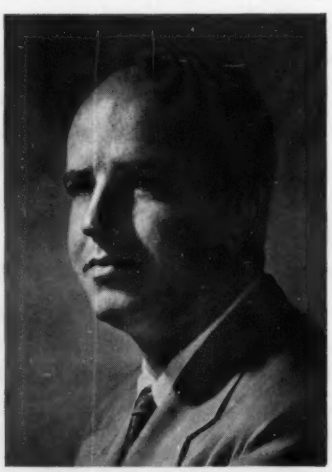
ALFRED A. BINKERD has been appointed sales representative in the metropolitan New York and northern New Jersey area for Russell Birdsall & Ward Bolt and Nut Co., Port Chester, N. Y. He will make his headquarters in Englewood N. J.

Ohio and Indiana

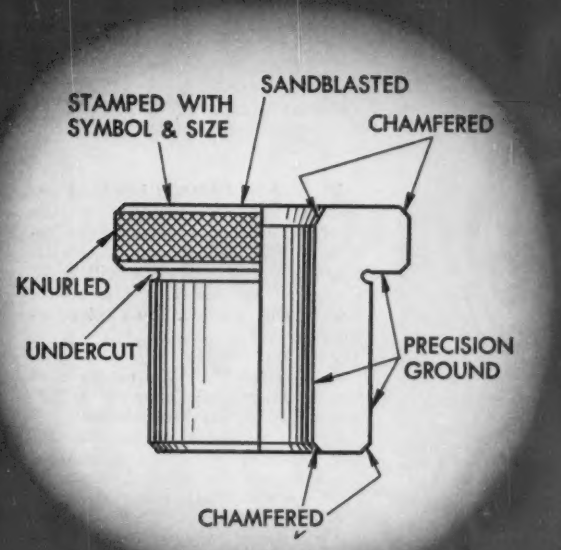
BRUSH ELECTRONICS Co., Cleveland, Ohio, has appointed the following five representatives for its Surfindicator, a precision instrument for measuring surface roughness: DOLPH BOETTLER & Co., 6625 Delmar Ave., St. Louis, Mo., who will cover the territory including the state of Missouri and the Counties of Madi-

Sheldon V. Clarke, manager general purchasing department, Union Carbide and Carbon Corporation

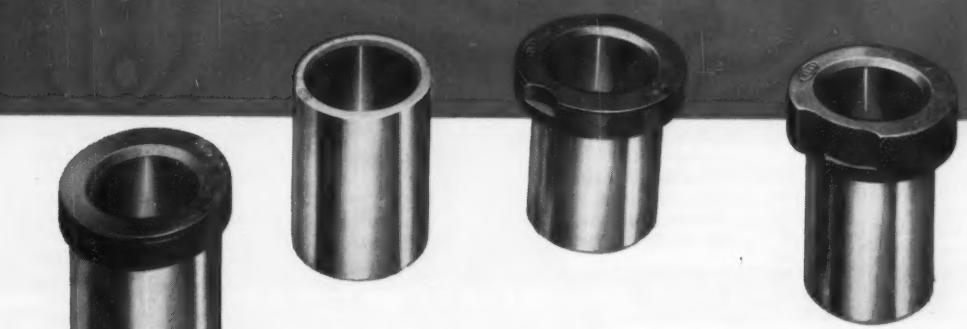
James C. Mabe, Jr., manager of plant operations, Chicago Pneumatic Tool Co.



Frank E. Sullivan, chief engineer—industrial processes, De Laval Separator Co.



THE INSIDE STORY OF EX-CELL-O DRILL JIG BUSHINGS



Here are a few good reasons why Ex-Cell-O Drill Jig Bushings last longer and perform better:

1. High carbon chrome bearing steel is selected for maximum wear and deep-hardened to 62-64 Rockwell "C" in automatic equipment.
2. Every bushing must measure up to Ex-Cell-O precision standards, as well as to A.S.A. standards.
3. High finish is ground on inside and outside diameters, and *under the head* for perfect bearing.

The country's largest users of bushings are Ex-Cell-O customers. Order from the Ex-Cell-O Catalog.

To satisfy the needs of your purchasing and engineering departments be sure to have an adequate supply of Ex-Cell-O Bushing Catalogs. Ask for the number of copies you need.

XLO
EX-CELL-O for PRECISION

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

54-34

son and St. Clair in Illinois; CLAUDE MANN & ASSOCIATES, 2514 East Douglas, Wichita, Kan., who will cover the states of Oklahoma and Kansas, and the counties of Jasper and Newton in Missouri; GLADE IVES, 1421 McGee St., Kansas City, Mo., who will serve the states of Nebraska, Kansas, and Missouri; ENGINEERING SALES CO., 112 Portwood, Houston, Tex., who will handle the state of Texas; WEPFER ENGINEERING SALES CO., 640 Harvey Road, Memphis, Tenn., who will cover Louisiana, Mississippi, and Tennessee; and ARGOST, FROST & GRANT, INC., 50 Church St., New York City, who will cover the states of New York and New Jersey.

CHRYSLER CORPORATION, Detroit, Mich., has announced plans to build a multi-million dollar plant for metal stamping and fabricating which will cover 1,500,000 square feet. The plant will be located in Summit County, Ohio, situated on a 300-acre site midway between Cleveland and Akron.

CHARLES T. VOYLES has been appointed sales representative by J. H. WILLIAMS & Co., Buffalo, N. Y. He will cover the territory of southeast Illinois, southern Indiana, northern Kentucky, and the Cincinnati area. Mr. Voyles will make his headquarters in Indianapolis, Ind.

TIMKEN ROLLER BEARING CO., Canton, Ohio, announces the following promotions: RALPH W. UPDEGRAFF has been promoted from chief industrial engineer, Bearings Division, to chief industrial engineer of the Timken Roller Bearing Co.; ROSS RUSSELL, who has served as senior industrial engineer in the Bearing Division, has been made divisional industrial engineer for the Steel and Tube Division.

Ralph W. Updegraff, chief industrial engineer, Timken Roller Bearing Co.

Albert L. Fisher, sales engineer, Indianapolis, Ind., office of E. W. Bliss Co.

ALBERT L. FISHER has been appointed sales engineer with the Indianapolis, Ind., office of the E. W. Bliss Co., Canton, Ohio. Before assuming his present position, Mr. Fisher was with the Canton Division as product design engineer.

JOE BUNGARTZ, West Coast field engineer for Cincinnati Milling & Grinding Machines, Inc., Cincinnati, Ohio, has been promoted to western district manager. He has been with the company since 1939.

GEORGE BAILLIE, JR., has been made sales manager of the Rolling Mill Division, Salem, Ohio, for E. W. Bliss Co., Canton, Ohio.

MAD RIVER SUPPLY CO., 42-46 W. High St., Springfield, Ohio, has been appointed distributor for the Hy-Pro Tool Co., New Bedford, Mass.

E. W. BAUMGARDNER has been made sales manager of the Trabon Engineering Corporation, Cleveland, Ohio.

Pennsylvania

ROCKWELL MFG. CO.'S DELTA POWER TOOL DIVISION, Pittsburgh, Pa. announces the appointment of the following sales managers: U. E. MCCARTY has been assigned to the district including most of Georgia, North and South Carolina, eastern Alabama, and eastern Tennessee, succeeding HOWARD L. ROSE, who recently retired; and JOHN M. BANNON, JR., has taken charge of the north Texas district, replacing Mr. McCarty.

ERIE FOUNDRY CO., Erie, Pa., has appointed the following representatives: JULIAN M. PAXICK, general manager for both forging and hydraulic machinery, in southern Ohio and West Virginia; BEESLEY-HOFMANN, 438 Delaware Ave., Buffalo, N. Y., for hydraulic presses in western New York State; and MACHINE TOOLS AND SPECIAL MACHINERY SUPPLY CO., 307 E. Fourth St., Cincinnati, Ohio.

PHILLIP A. CARLSON has been appointed regional manager of the newly created midwestern sales region of SKF Industries, Inc., Philadelphia, Pa. Mr. Carlson will be in charge of the Chicago, Milwaukee, Minneapolis, and St. Louis sales territories.

J. W. ELLIOTT, works manager of the Brubaker Tool Corporation, Millersburg, Pa., has been elected vice-president of the corporation. He will also continue to serve as general manager of the Morton Machine Works a subsidiary corporation.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., has made the following changes: WALTER W. ARMSTEAD, JR., has been appointed to the Indianapolis, Ind., sales office and NEALE CARTER has been assigned to the Birmingham, Ala., district sales office.

KENNAMETAL, INC., Latrobe, Pa., announces the following executive changes: GEORGE J. HEIDEMAN has been elected treasurer; and CHARLES R. VAN NORDEN has been elected secretary to succeed GEORGE T. KEARNS, who died September 25.

CLAY R. BRAHM has joined the sales staff of the metal processing chemicals department of the Pennsylvania Salt Mfg. Co., Philadelphia, Pa. He replaces FRANK WILCHER, who has been transferred to Louisville, Ky.

LEWIS W. KING has been appointed assistant to the vice-president of engineering of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. RALPH H. SCHOLL has been named manager of the roll department.

PETER B. DAVIES has been appointed assistant sales manager of the Philadelphia Gear Works, Inc., Philadelphia, Pa. He has been with the company since 1948.

Wisconsin

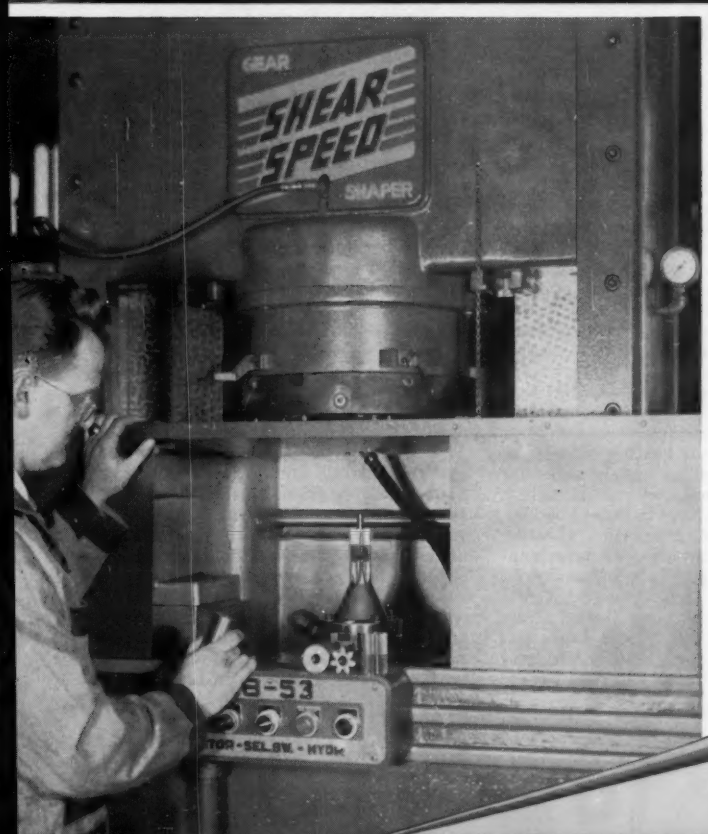
W. H. COLLINS has been appointed northeastern district sales manager for the Trent Tube Co., East Troy, Wis., a wholly owned subsidiary of Crucible Steel Company of America, Pittsburgh, Pa.

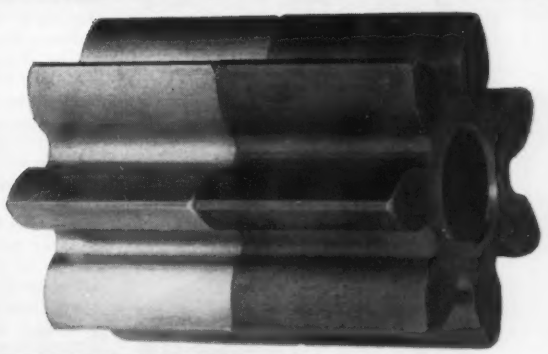
ALLEN W. SALZMAN has been made chief engineer of the Waukesha Tool Co., Waukesha, Wis. He will also head the company's new Thrust Bearing Division.

This Month's

GEAR PIX

RECORD SETTERS are these Shear-Speed gear shapers shown in final stage of assembly. More and more of these machines that cut all teeth simultaneously in a gear or similar toothed part are helping to set today's production pace.





CAST BLANK ON BOTTOM, steel blank on top, eliminates burrs when all teeth on both gears are cut simultaneously on Shear-Speed gear shapers. These mating automotive oil pump gears operate more smoothly due to close tolerances, smooth surface finishes, and perfectly formed 0.080-inch radii at the tooth fillets with no scallops or ridges. Three Shear-Speed gear shapers produce these gears for one of the best known automobiles.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD.

Orrin W. Barker, vice-president of engineering, Kearney & Trecker Corporation

ORRIN W. BARKER has been elected vice-president in charge of engineering of the Kearney & Trecker Corporation, Milwaukee, Wis. He succeeds JOSEPH B. ARMITAGE, who will continue as vice-president—consultant of the company. Mr. Barker began his employment with Kearney & Trecker in 1925 as a machine designer. Three years ago he was named chief engineer and has remained in that capacity until now.

Obituaries

JOHN HULST, former vice-president of United States Steel Corporation, New York City, and one of the foremost engineers in the steel industry, died recently in Grand Rapids, Mich., at the age of eighty-three years. Mr. Hulst retired from United States Steel in July 1942 after forty years' service.

GEORGE T. KEARNS, secretary-treasurer and director of Kennametal, Inc., Latrobe, Pa., died on September 25th at his home in Greensburg, Pa., at the age of fifty-four years.

* * *

Internal Revenue Rulings on Leasing of Industrial Equipment

Machinery & Allied Products Institute has published Bulletin 3311 incorporating the full text of three recent Internal Revenue rulings on the leasing of industrial equipment, together with an Institute critique of such rulings. Single copies of the Bulletin at a cost of ten cents each are available at the Institute's Washington office, 1200 Eighteenth St., N. W., Washington, D. C.

New Books and Publications

DESIGN OF HEATING AND VENTILATING SYSTEMS. By F. W. Hutchinson. 320 pages, 6 by 9 inches, 98 illustrations. THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, $7.

This book, written by a professor of mechanical engineering at the University of California, offers a ready means of solving complex formulas in the mathematical areas of design by the use of ninety-six working charts accompanied by explanatory test and examples. The book deals primarily with engineering science as applied to system design rather than with the engineering art of selecting and integrating such elements as are available in standard form. Emphasis is placed on problems which require the rational application of engineering knowledge.

In two sections of the book—those dealing with load evaluation and with combustion—analyses and graphs are presented.

A valuable feature is the provision of full page graphical solutions of the most important equations in each chapter. In many cases, use of the graphs entirely eliminate calculation, while in others, the graphs serve to minimize the mathematical work needed in solving the equations.

Another feature of the book is the inclusion of complete design data for systems which operate with intent to utilize partial solar heating through the use of large windows. It is believed that this is the first text on heating to include engineering data on this increasingly important subject.

The discussion of comfort takes into account all those elements which have been demonstrated as within the province of engineering control. Chapters on load determination include complete discussions of transmission losses, intermittent heating, ventilation and humidification loads, and losses from ducts and pipes. The chapter on air distribution offers a means of evaluating friction loss in all elements of the system and presents design methods with graphical solutions to problems in fan selection, power requirements, and performance.

Design procedures are set forth for conventional heating systems of all types as well as radiant and solar heating systems.

Chapter headings include: Load Determination—Transmission Losses; Load Determination—Intermittent Heating; Load Determination—Ventilation and Humidification; Load Determination—Losses from Ducts, Pipes, and Tubes; Fuels and Combustion; Air Distribution; and Conventional Heating System Design Procedure.

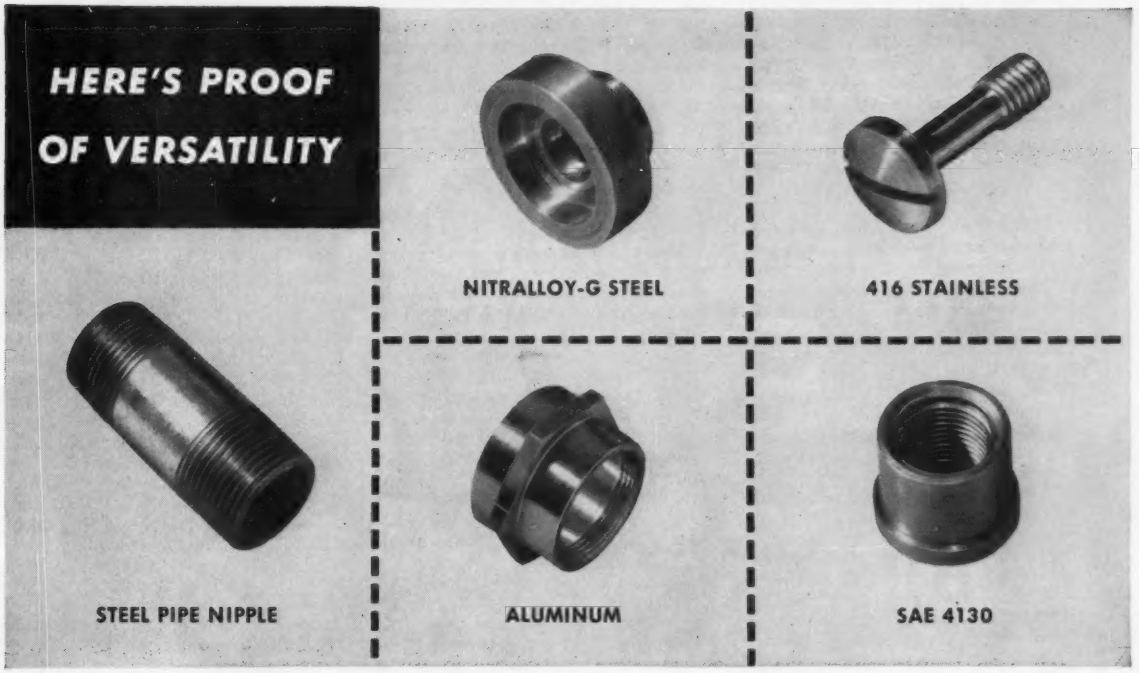
THE NEW AMERICAN MACHINIST'S HANDBOOK. Edited by Rupert LeGrand. 1572 pages; 5 1/2 by 8 inches; over 1000 illustrations. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $11.

Based upon earlier editions of the *American Machinist's Handbook* by Fred H. Colvin and Frank A. Stanley, this new handbook appears in larger page size and with rearranged and rewritten contents. A total of eleven main sections are provided covering the topics: machining methods; metal-forming methods; assembly methods; materials; finishing of metals; inspection; fastening devices; tool engineering and drafting practice; machine-tool standards; power-transmission equipment; and mathematics and tables. These main topics are further subdivided into a total of forty-five headings. The intent is to have related material grouped together for easier reference.

Rupert LeGrand is senior associate editor with the *American Machinist* and has written on many subjects for the metal-working industry—machining processes, machinability, pressworking of metals, inspection, and materials.

INVESTMENT PRECISION CASTING. 58 pages, 5 1/2 by 8 1/2 inches; 38 illustrations. Published by the Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, 75 cents.

This latest addition to the British *Machinery's* Yellow Back Series covers the application of the lost-wax process to the production of engineering components to fairly close limits. The advantages and disadvantages of the process are discussed. Design considerations and dimensional limits are pointed out. Dies for producing wax patterns are described. Various waxes and wax injection machines are covered. The making of wax patterns and mercury patterns is gone into in some detail together with the investment operation and the waxing and firing of the mould. The book concludes with a description of the process of pouring the casting and types of furnaces. A description is given of the *Investril* system which has been developed for manufacturers who are anxious to use the lost-wax process but are not producing in sufficient quantities to justify a full-scale lost-wax foundry. This system makes use of relatively simple equipment and rubber moulds. It was originally introduced by W. J. Hooker of London, England.



SUN DEVELOPS VERSATILE NEW CUTTING OIL FOR SCREW MACHINES AND JOB SHOPS

New cutting oil, Sunicut 5534, is moderately priced...gives excellent machining results on wide range of steels

New Sunicut 5534 is a non-emulsifying, transparent cutting oil specially compounded to give above-average machining results to operators who want a single oil to machine a large variety of ferrous metals.

Tests have proved that new Sunicut 5534 meets this demand for an all-purpose cutting oil. It is ideal for general screw machine and turret lathe work. It is also excellent for tapping, drilling, threading, and light stamping operations. In addition, new Sunicut 5534 can be used on many special machining jobs, both high and low speed, with metals ranging from B1112 to 4130 as well as free-machining stainless steels.

For complete information about new Sunicut 5534 and how it can help you reduce your oil inventories...lower your production costs...see your Sun representative. Or write SUN OIL COMPANY, Phila. 3, Pa., Dept. M-11.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY, PHILADELPHIA 3, PA.

IN CANADA: SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

CAPSTAN & TURRET LATHE PRACTICE. By C. Monday. 199 pages; 5 1/2 by 8 3/4 inches; 212 illustrations. Published by the Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, $3.

Using British machines as examples, this work presents in the opening chapter an excellent description of the types and general constructional features of capstan and turret lathes. Chucks, work-holders, and adapters are also discussed in detail. In a particularly noteworthy chapter on cutting tools, the various materials used for cutting tools are compared, the shapes of typical bar-turning tools with respect to rake and clearance angles and to general contours are analyzed, and the effects of rake and clearance on form tools, both straight and circular, are made clear. In the chapters which follow, each major type of cutting operation —turning, facing, drilling, boring, reaming, and thread cutting—is taken up in detail. A final chapter gives many excellent examples of tooling and setting up arrangements.

MACHINERY'S SCREW THREAD BOOK, 16th Edition. 223 pages, 5 1/2 by 8 1/2 inches; 48 illustrations. Published by the Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, $2.50.

This well-known compendium of screw thread standards has been completely revised and re-written for the 16th Edition. Included are tabulated data, formulas, and diagrams for British threads, American threads, and European threads. Horological and other special threads are included. An entire section is devoted to the inspection of threads by the wire method. Errors due to pitch and flank angle deviations are discussed and their effects noted. Another section covers nut, bolt, and screw dimensions for various British, American, German, and French standard designs. A final section gives tapping sizes and percentage basic depths of threads for various British and American threads. A glossary of English, French, and German thread terms is included.

SHELL MOULDING (Part Two). 82 pages, 5 1/2 by 8 1/2 inches; 71 illustrations. Published by the Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by The INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, 75 cents.

Since the appearance of the first volume on the subject of shell moulding in British *Machinery's* Yellow Back Series, there have been further advances in the technique and a number of new shell-mould making machines have been built, each having distinctive features. The present volume was published to present this information and to provide additional data with respect to mould making and the casting procedures for various metals.

There are numerous illustrations of shell-mould making machines, shell moulds, patterns, and pattern plates. The material presented is based on British practice.

The chapters of the book are entitled: Shell Mould Making Machines and Equipment; Methods of Clamping and Backing up the Mould; New Techniques; Shell Moulding Practice for Various Materials; Casting Agricultural Machinery Gears; and Casting Motor Car Parts.

The previous Yellow Back (No. 34) on Shell Moulding is also available.

DIE DESIGN HANDBOOK. Frank W. Wilson, executive editor. 768 pages; 6 by 9 inches; 685 illustrations. Published under the sponsorship of the American Society of Tool Engineers by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $14.50.

This is a comprehensive and practical handbook which covers the design of dies of all types and the properties of die and stamping materials. Information is given on product design factors, principles of process planning, theory of metal movement, die-setting principles, and selection of presses. Included in this handbook are topics of recent interest such as the properties of titanium, zirconium, and tantalum; methods of pressworking these metals; the cold extrusion of steel; and dies, presses, and operations for the newer hydraulic-action and rubber-action forming methods.

The book is copiously illustrated with detailed diagrams showing a wide variety of dies and parts produced in dies. Numerous tables of helpful data on the properties of ferrous, non-ferrous and non-metallic die materials are presented.

In a section on miscellaneous dies, there is information on bulging dies, reducing and necking dies, ironing, stretch-forming, eyelet machine tools, assembling dies, riveting and staking dies, and crimping dies.

MACHINE DESIGN (Second Edition). By Paul H. Black. 471 pages, 6 by 9 inches. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $7.50.

This is a thorough revision of a book written to acquaint the student and engineer with the design of machine elements, and the design and selection of units of power transmission, of strength, rigidity, wear, and economy of manufacture, and operation. The emphasis is on practical design applications rather than academic problems.

Chapter headings are as follows: Machine-design Computations; Loading, Induced Stresses, and Failure; Stress Concentration in Machine Members; Allowable Stresses; Members That Fail by Buckling; Engineering Materials; Mechanical Fabrication and Processes; Detachable Fastenings; Springs; Pressure Cylinders; Translation Screws; Shafting; Belt Drives and Hoists; Power-transmission Chains; Shaft Couplings; Clutches and Brakes; Spur and Parallel Helical Gears; Gears for Nonparallel Shafts; Surface Finish, Friction, and Wear; Sliding Bearings and Lubrication; Rolling Contact Bearings; Metal Fits and Tolerances; Vibration and Vibration Control; and Motor Selection.

MANUAL OF LATHE OPERATION. 32 pages, 6 by 9 inches. Published by Atlas Press Co., 2353 N. Pitcher St., Kalamazoo, Mich. Price $1.50 postpaid.

This book on metal-working lathe technique has recently been revised by the publisher. It illustrates and describes the care and operation of modern screw-cutting lathes.

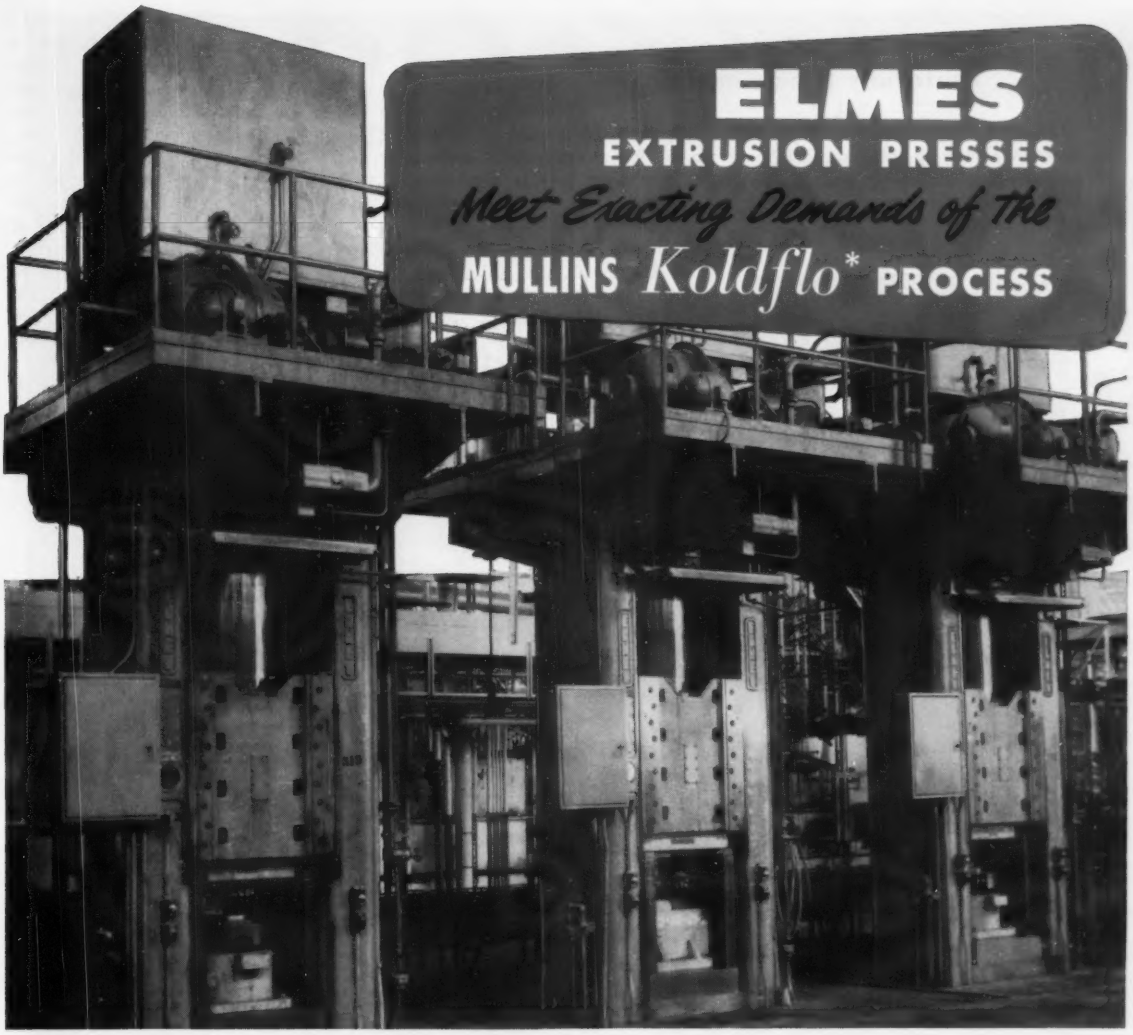
The manual contains the following chapter headings: Metal Cutting; Cutting Tools; The Machining of Various Materials; Holding the Work; Drilling and Boring; Thread Cutting; Lathe Attachments and Their Use; Woodturning on the Metal Lathe; Machinists Tables; Index; and Shop Notes.

Coming Events

NOVEMBER 9-12—Annual meeting, NATIONAL SOCIETY OF ALUMINUM DISTRIBUTORS at the Arizona Biltmore Hotel, Phoenix, Ariz.

NOVEMBER 14-18—Chicago Exposition of Power and Mechanical Engineering, under the auspices of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS, in conjunction with their Seventy-fifth Anniversary Meeting, to be held in the Chicago Coliseum, Chicago, Ill. Further information can be obtained from the International Exposition Co., 480 Lexington Ave., New York 17, N. Y.

MARCH 19-23—1956 Industrial Exposition sponsored by the AMERICAN SOCIETY OF TOOL ENGINEERS to be held at the International Amphitheatre, Chicago, Ill. For further information write to Harry Conrad, executive secretary, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich.



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"PLI" Washers Insure Tighter Joints with Uniformly Pre-Loaded Structural Bolts

Lighter, tighter, and longer-lived structural bolt connections are made possible by a new pre-load indicating device called the "PLI" washer, now being manufactured by the Standard Pressed Steel Co., Jenkintown, Pa. This washer is actually a compact assembly of two concentric steel rings as shown in Fig. 1. One of the washer rings is compressed in the manner illustrated in Fig. 2 when the bolt is tightened. The washer provides an accurate, virtually fool-proof means for pre-loading bolts to as much as 80 per cent of their yield strength. This high pre-load is said to be almost twice the average one ordinarily induced with torque wrenches. It is intended to insure tighter structural connections as well as longer bolt life.

Fig. 1. PLI washers for structural bolts designed to insure tighter joints and uniform pre-loading

A complete nut and bolt assembly with PLI washer is shown prior to pre-loading in the view at the left, Fig. 2. At the right, cross-section views of the PLI washer and auxiliary washers show how the inner ring is compressed to the height of the outer ring to induce automatically and accurately the predetermined pre-load. Before compression the inner ring fits freely inside the outer ring and is greater in height than the outer ring. The design is such that it takes a predetermined load to compress the inner ring to the height of the outer ring.

When in use, the PLI washer is sandwiched between two high-strength washers and placed under the head of the bolt or under the nut. As the bolt is tightened, the inner ring takes the load. Continued tightening, first elastically and then plastically, compresses the inner ring. The outer ring is free to move until the inner ring is compressed to the point where the adjacent washer bottoms on the outer ring. At this point the outer ring binds and the desired pre-load is applied to the bolt.

To detect the binding point, the outer ring is wiggled by means of a feeler handle—actually a disposable length of thin gage wire—inserted into any one of three holes provided on the outer circumference of the ring. Since, in the plastic stage, compression of the inner ring occurs with very little increase in applied load, the end or seating point is very positive and does not vary.

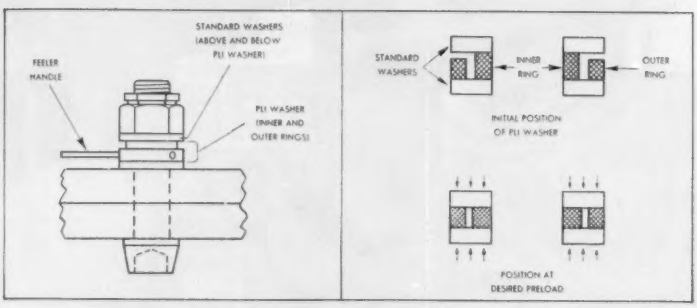

Fig. 2. (Left) Assembly of PLI washer and bolt. (Right) Diagrams illustrating pre-loading principle of PLI washer

Awards Promote Welding in Design of Machine Tools

Dr. Max Kronenberg, consulting engineer, Cincinnati, Ohio; and Paul Maker and Edward Dix, senior research engineer and project and design engineer, respectively, Bryant Chucking Grinder Co., Springfield, Vt., shared the $3000 first award in the recent $12,000 Machine Tool Design Award Program sponsored by the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio. The award was made for a joint paper on development work in the design of a new Bryant grinding machine of welded steel construction.

It is claimed that this machine offers higher speeds than conventional grinders by having greater rigidity and freedom from vibration. Grinding time is said to be reduced by as much as 50 per cent, and better finish and less dimensional variation are possible.

Leonard McDermott and Richard Fleury, foreman and stylist, respectively, Brown & Sharpe Mfg. Co., Providence, R. I., shared the $2500 second award. Their paper described successive redesigns of a grinding machine base from a simple copy of a casting to one tailored to take full advantage of the economies afforded by welded fabrication. A saving of 37 per cent was realized.

George Kasselmann, design engineer, R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, received the third award of $2000. His entry concerned a 36-foot template carrier rail for a roll-turning lathe. By welding, the rail was increased in rigidity, thus maintaining straightness tolerances even though weight was reduced from 7000 to 3000 pounds.

Fourth award of $1500 went to Alex Durand, Falk Corporation; and fifth award of $1000 to William Morgan, Clearing Machine Corporation. Honorable mention awards of $200 were made to engineers of The Cross Company, Joseph T. Ryerson & Son, Allison Division of the General Motors Corporation, Cone Automatic Machine Co., National Automatic Tool Co., Warner & Swasey Co., Zagar Tool, Inc., Curtis Machine Corporation, Chicago Pneumatic Tool Co., and Kearney & Trecker Corporation.

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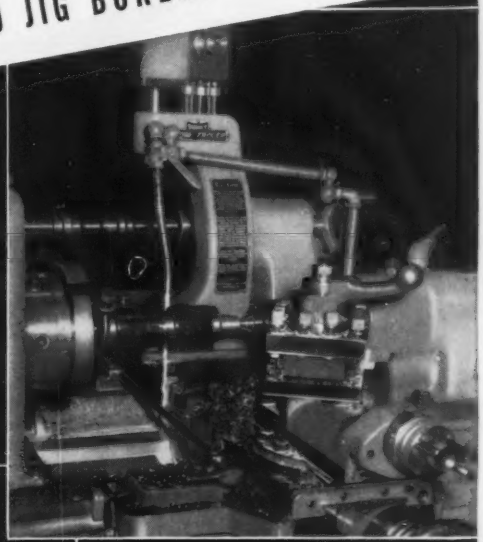

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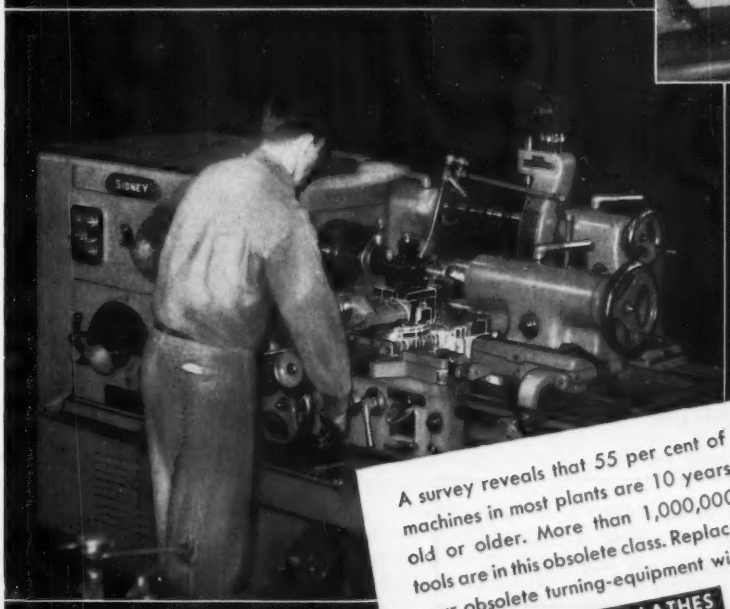

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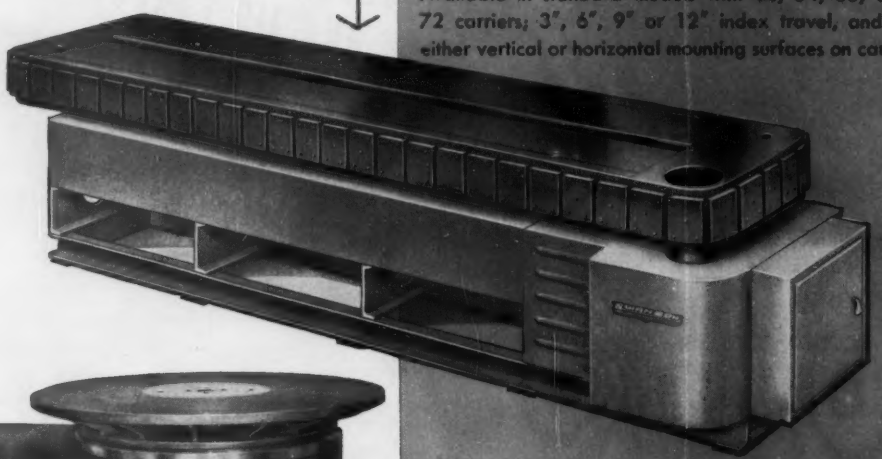

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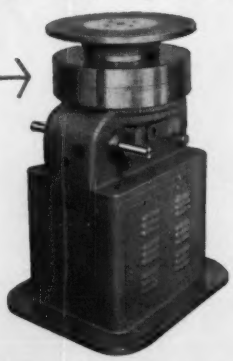

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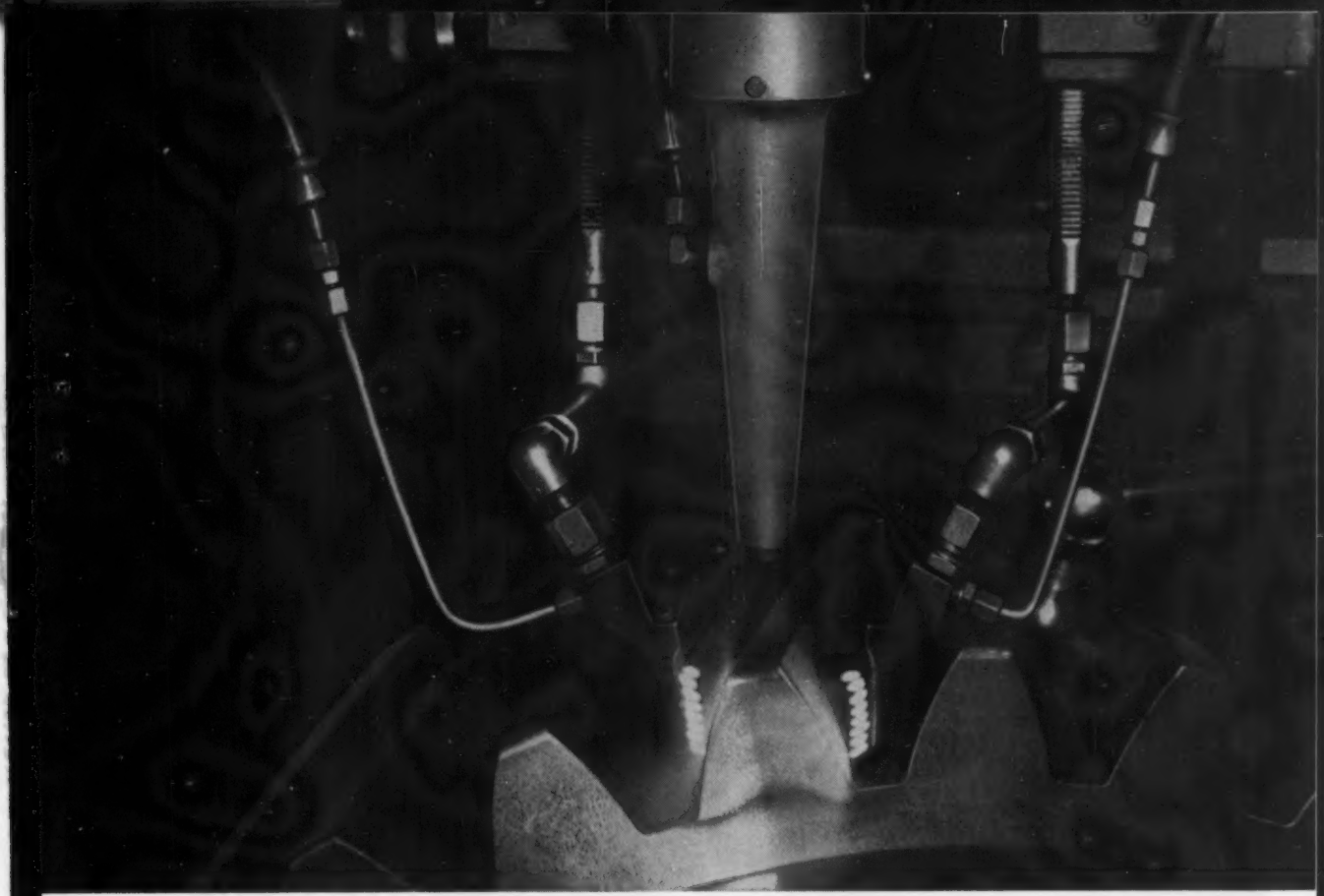

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surface hardening of gear teeth

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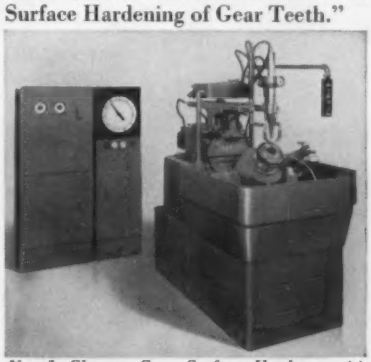
Gleason Surface Hardeners assure absolute uniformity of all teeth on a gear and every gear in a lot. They are adaptable to hardening straight bevel, spiral bevel, Zerol® spur, herringbone and helical gears. For additional information, write for the booklet "The Surface Hardening of Gear Teeth."



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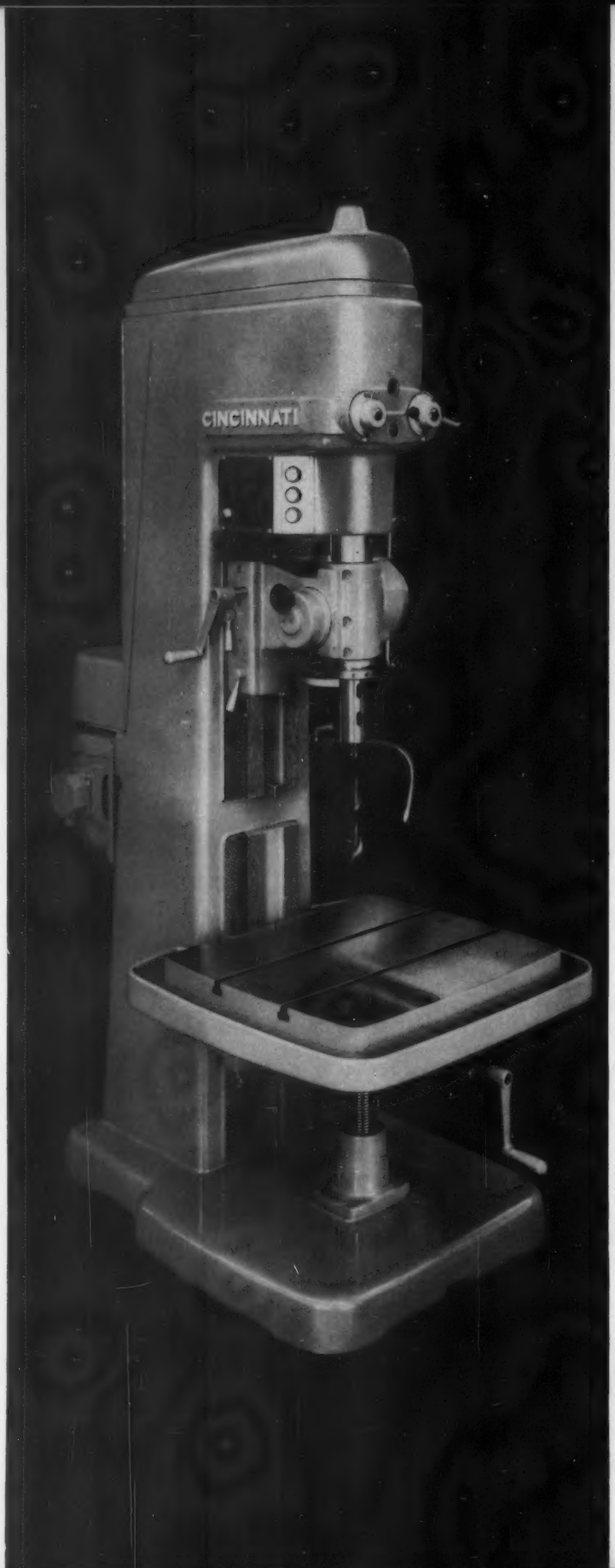

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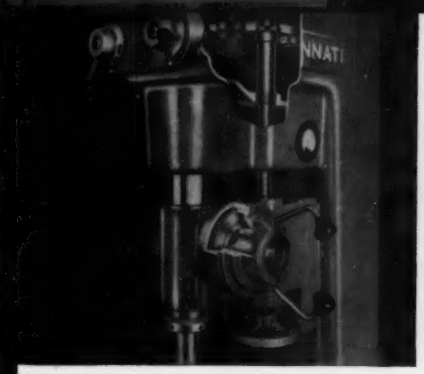

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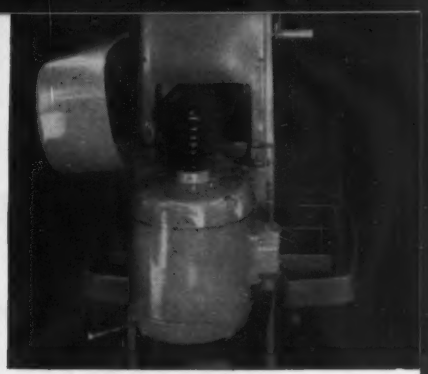

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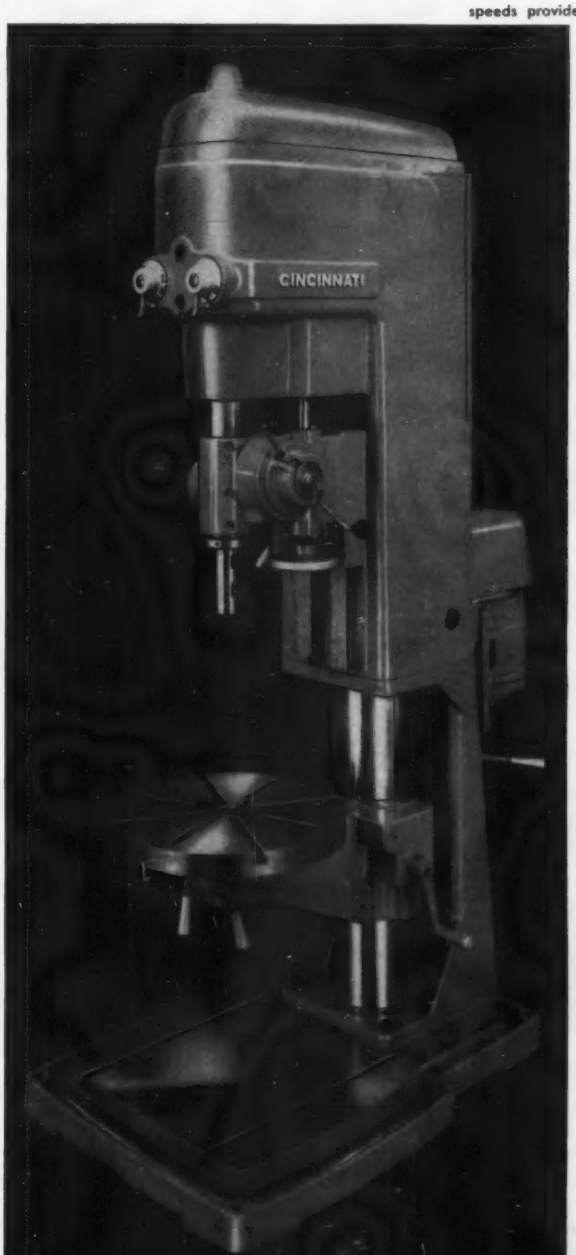

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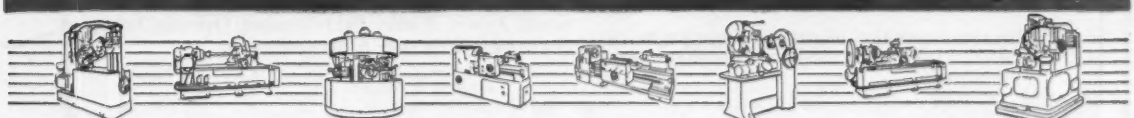

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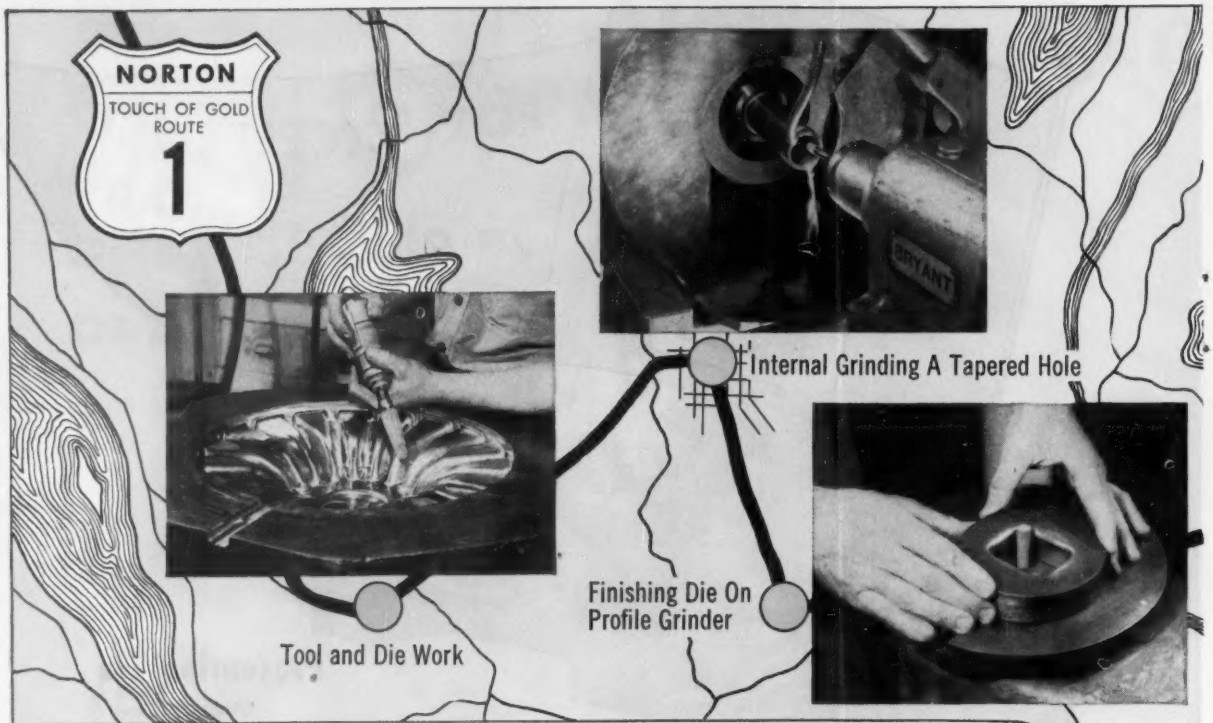

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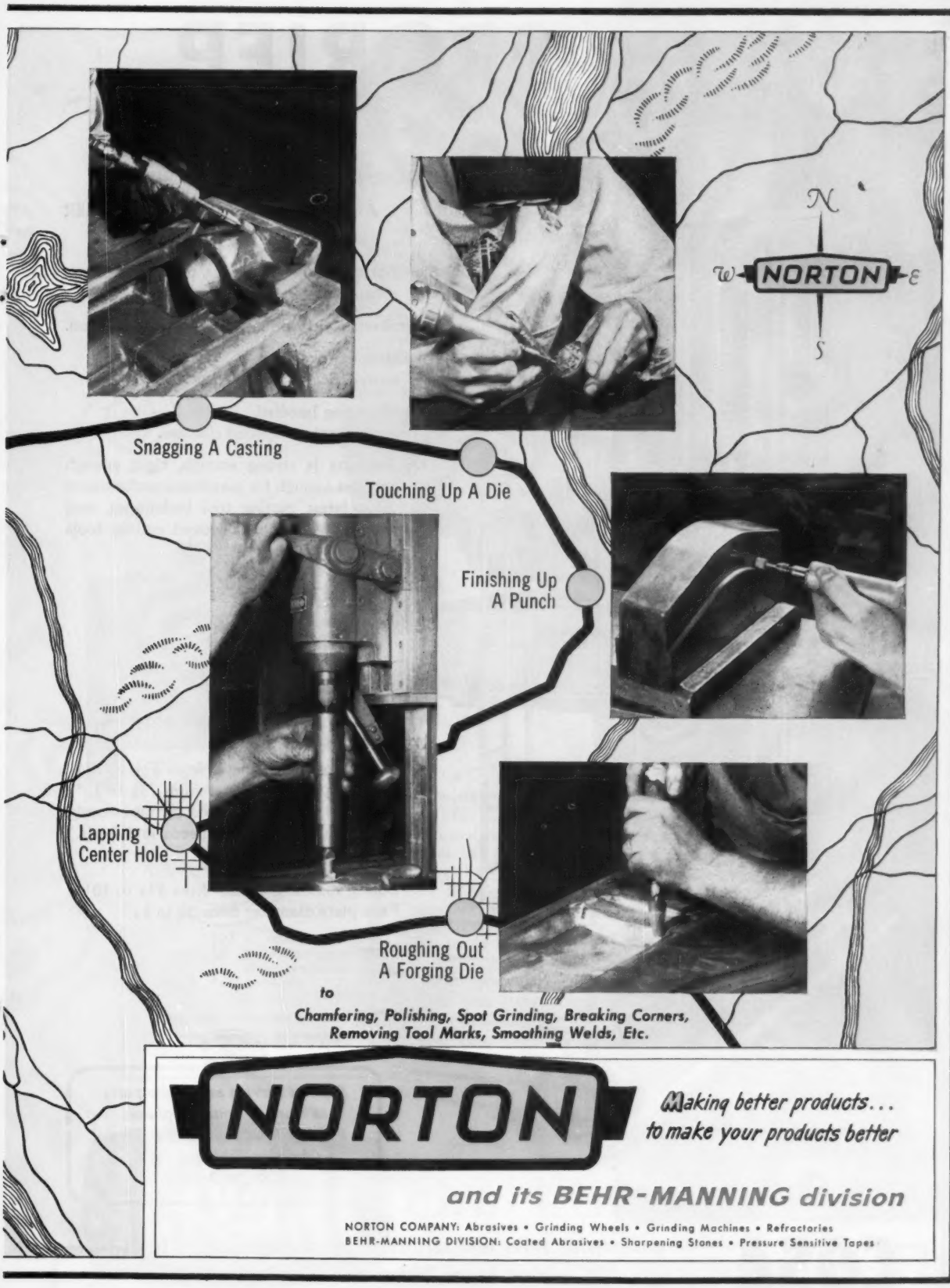

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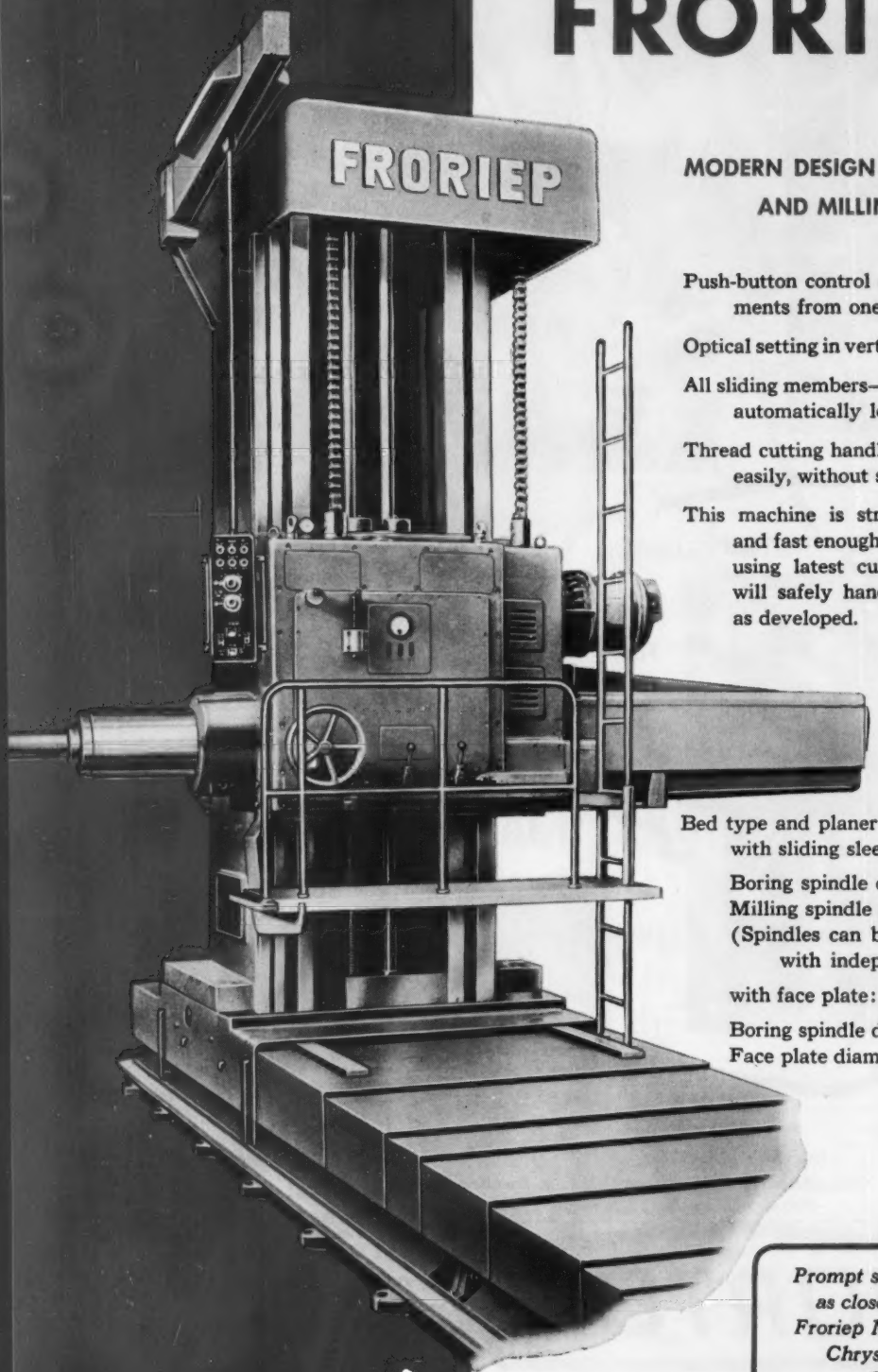

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Thread cutting handled
easily, without special changes.

This machine is strong enough, rigid enough and fast enough for maximum performance using latest cutting tool techniques, and will safely handle improved cutting tools as developed.

Bed type and planer type, large capacities, with sliding sleeve:

Boring spindle diameter from 5⅛ to 8⅞"
Milling spindle diameter from 7⅞ to 15"
(Spindles can be operated simultaneously with independent speeds and feeds.)

with face plate:

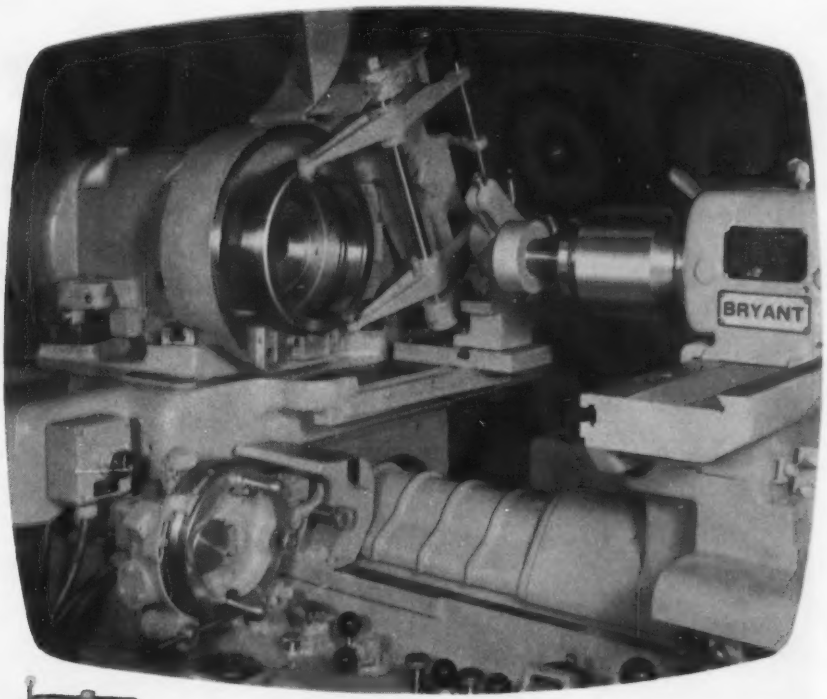
Boring spindle diameter from 5⅛ to 10¼"
Face plate diameter from 30 to 51"

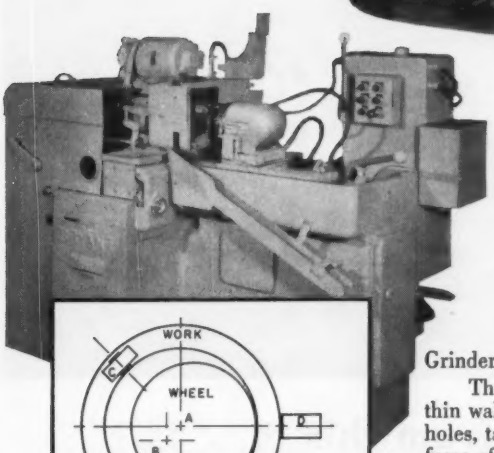
Prompt service and spare parts as close as your telephone.
Froriep Machine Service Corp.
Chrysler Building, N.Y.
ORegon 9-3560

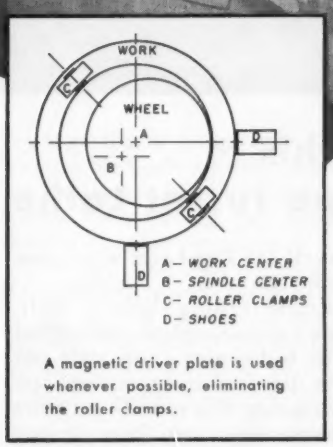
COSA *nationwide sales and service of precision machine tools—from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

SHOE CENTERLESS GRINDING WITH...







A magnetic driver plate is used whenever possible, eliminating the roller clamps.

BRYANT internal grinders gives you HIGHER PRODUCTION and LOWER COSTS

Experience-proven tooling and fixtures help make Bryant Internal Grinders exceptionally accurate . . . efficient . . . productive.

The shoe-type centerless internal grinding fixture is typical. Extremely thin wall rings can be shoe centerless ground to close tolerances. Straight holes, tapered holes and contours, having cylindrical, conical or other surfaces of revolution can be ground by this method.

Shoe centerless grinding ensures bore grinding to a uniform wall thickness with concentricity held to less than .0001". It is particularly successful when previous O.D. and face grinding operations have been closely controlled. Distortion caused by conventional clamping is eliminated.

Shoe centerless grinding speeds up loading and unloading of work parts, whether manual or automatic. Change-over from job to job is easier and faster than with conventional grinding fixtures.

Bryant grinders offer you operating economy—as well as peak production rates. Their adjustable precision alignment helps ensure maximum original accuracy throughout their lives. They require only a minimum of maintenance. Factors like these cut cost per piece.

***WRITE** for our "Alignment" booklet. Ask, too, for a reservation card for our sound, color movie, "Alignment for Better Internal Grinding"—free showings arranged for engineering groups.*

BRYANT

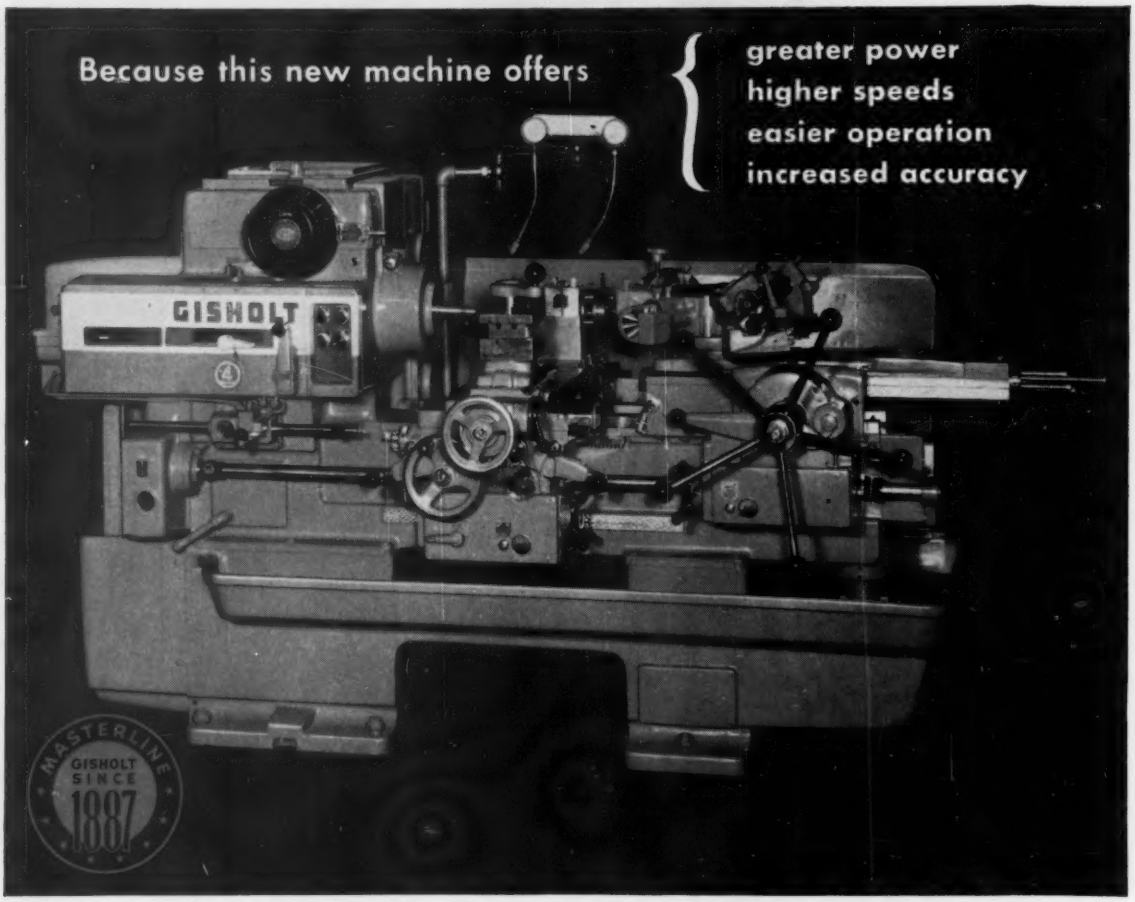
chucking grinder co.

SPRINGFIELD, VERMONT, U.S.A.

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

Let Gisholt help you find



You'll get more production from this new Gisholt Ram Type Turret Lathe

Typical of the great, new Gisholt MASTERLINE machine series, this Ram Type Turret Lathe gives you the advanced design features you *need* to help cut machining costs!

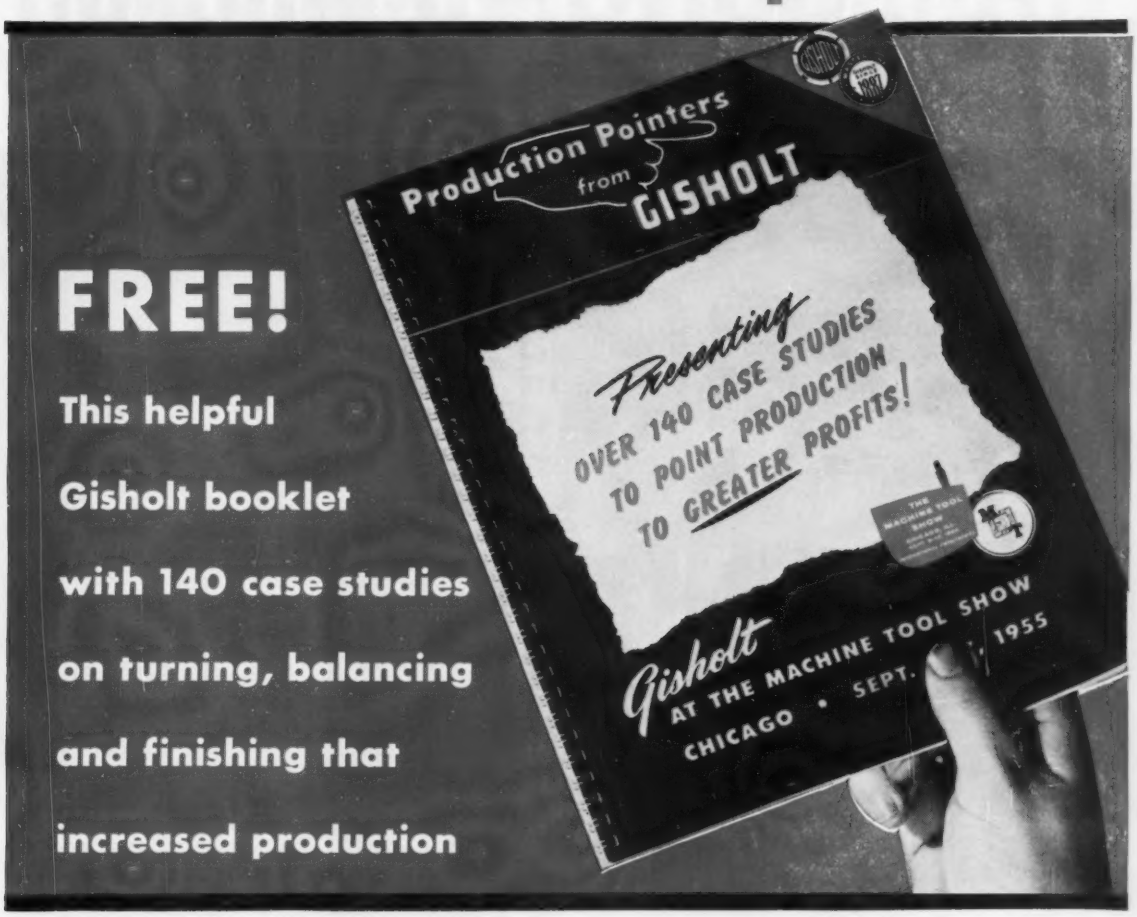
Here's more power (up to 30 h.p.!) and up to 16 speeds provided with a single-speed motor. And here's faster, easier selectivity; the new Hydraulic Speed Selector operates within a three-second cycle—direct or preset. A free spindle is available at all speed settings. Even on large speed change requirements, such as dropping from drilling to tapping, effort is kept at a minimum through the HI-LO Trip Lever which now offers a speed shift ratio of 8:1.

Add the Hydraulic Inching Control—Self-Adjusting Clutches—and a completely redesigned headstock; heavier bed casting, cross slide and ram; aprons with dial feed selectors—and you have some of the reasons why you will get more production, at *less* cost per unit, from the *new* Gisholt MASTERLINE Ram Type Turret Lathes!

Be sure to write Gisholt today for complete information about the new machines, or contact your Gisholt Representative.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

new short cuts to profits



You'll get lots of money-saving ideas when you read this big Gisholt Production Pointers booklet—a collection of 140 of the most outstanding case studies in turning, balancing and finishing! They're all ready for you in easy, usable form.

Here, you'll see both the methods and means of reducing setup and change-over time—simplified tooling—faster floor-to-floor operations that mean lower costs per unit produced. Through photos and drawings, you'll see setups that have solved some of the toughest problems—setups worked out by some of the nation's leading manufacturers to find better short cuts to profits—and to maintain (or frequently improve) quality of product.

By all means, take a minute of your time today to write for your big, illustrated Production Pointers Case Study booklet. Ask for Form No. 1180. Or, if you prefer, just contact your nearby Gisholt Representative.

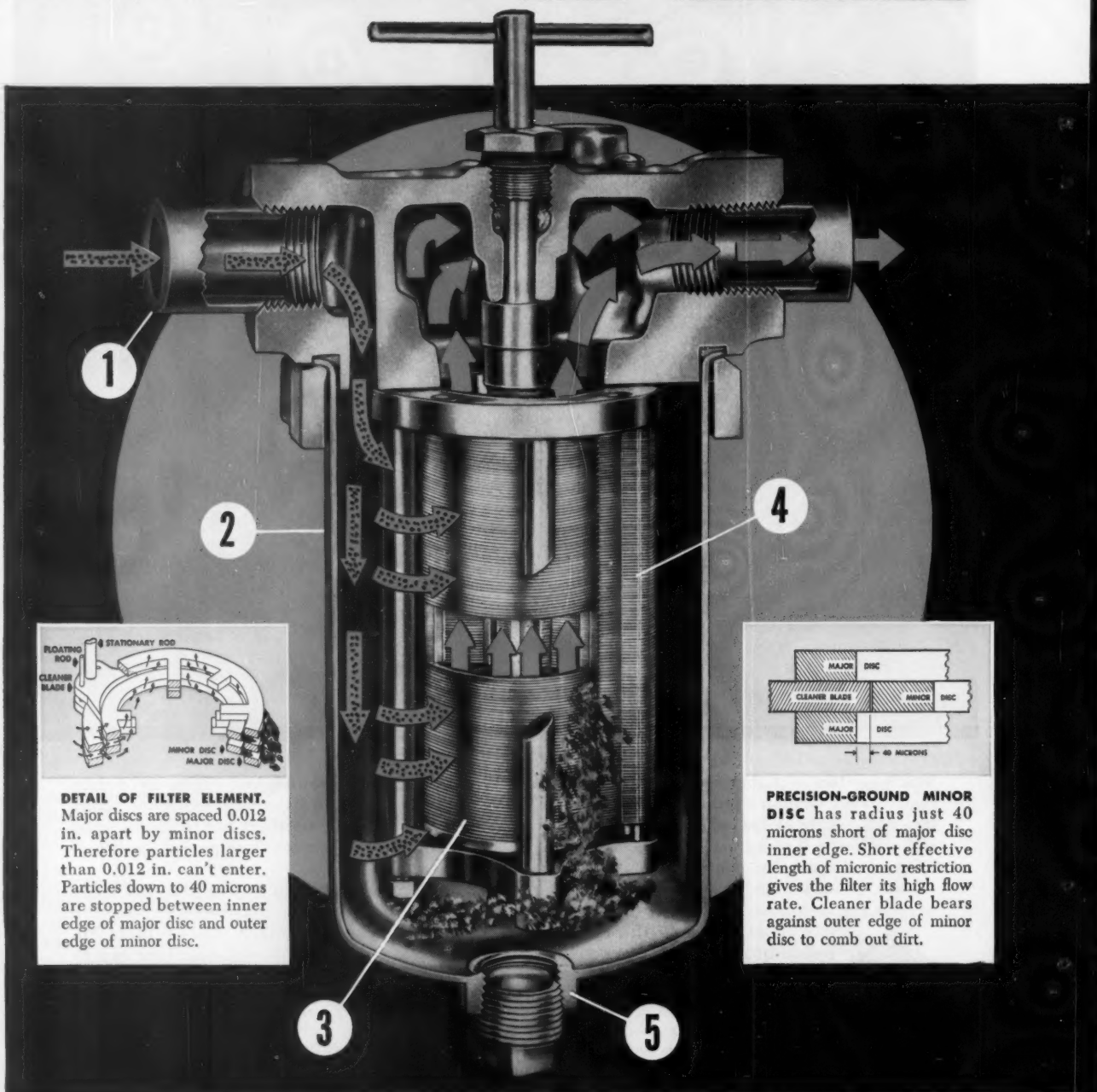
THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface finishing and balancing of round and partly round parts. Your problems are welcomed here.*

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

Gisholt Machine Company
120 E. Washington Ave.
Madison 10, Wis.
Gentlemen:
Please send my free copy of the new Production Pointers Case Study booklet, Form No. 1180.

Name.....*Title*.....
Company.....
Street Address.....
City.....*Zone*.....*State*.....

New! CUNO 40-micron



DETAIL OF FILTER ELEMENT. Major discs are spaced 0.012 in. apart by minor discs. Therefore particles larger than 0.012 in. can't enter. Particles down to 40 microns are stopped between inner edge of major disc and outer edge of minor disc.

PRECISION-GROUND MINOR DISC has radius just 40 microns short of major disc inner edge. Short effective length of micronic restriction gives the filter its high flow rate. Cleaner blade bears against outer edge of minor disc to comb out dirt.

CUTAWAY of new SUPER Auto-Klean. Dirty liquid enters inlet (1) at left, fills housing (2) and flows through metal-edge filter (3) of stacked major and minor discs. Trapped dirt is combed out by cleaner blades (4) when discs are rotated and is removed through drain (5). Clean liquid rises through center of filter element, leaves at right.

self-cleaning filter!

The SUPER Auto-Klean for lube, hydraulic fluid, coolant, fuel and other liquids

. . . and you can clean this filter by simply turning the handle!

Many times smaller than other micronic filters of equal capacity, Cuno's new SUPER Auto-Klean filter now makes possible economical, compact, micronic filtration at high flow rates and eliminates the need for replacement cartridges. On machine tools and industrial machinery, SUPER Auto-Klean gives micronic filtration of lubricating oil, hydraulic fluids, coolants, fuels and other liquids. Here's what it offers:

1. Full-flow micronic filtering with a self-cleaning filter. Filter can be cleaned continuously with motor drive or intermittently by manually turning handle.

2. Eliminates cartridge changes. Ends operating costs if you've been using cartridge filters.

3. No pressure drop build-up. An 8-in. long, 2¾-in. diameter cartridge handles 30 gpm of oil of 200 SSU viscosity with only 3 psi pressure drop—up to 75% more with slightly higher pressure drop.

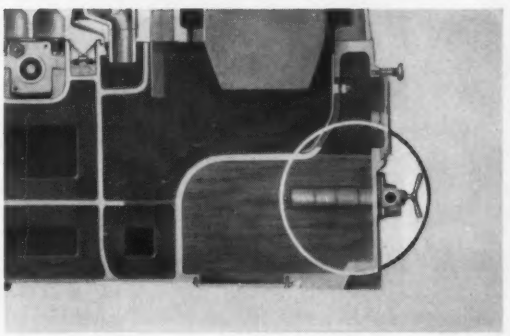
4. Positive protection against particles larger than 40 microns (actually 0.0015 in.). Filter can't rupture or channel.

5. Much smaller than replaceable-cartridge-type filters of equal capacity. It saves with lower initial costs, lower installation costs, requires less space than cartridge units. You get high capacity in a small package.

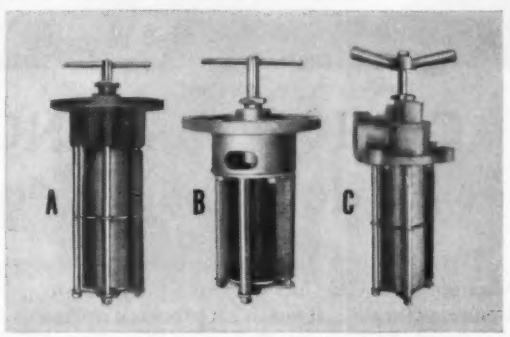
6. No duplex units needed. Handles full flow all the time with no interruptions for cleaning.

7. SUPER Auto-Klean fits existing Auto-Klean housings. You can easily replace most 2¾-in. diameter cartridges with SUPER Auto-Klean for finer filtration.

Send coupon for complete information on the new SUPER Auto-Klean filter, for your new designs or existing equipment. Cuno Engineering Corporation, 20-11 South Vine Street, Meriden, Conn. 5.6



WILL IT FIT? Here's how one designer answered that question. Filter *(circled)* mounts horizontally in side wall of hydraulic fluid reservoir in this surface grinder.



FILTERS FOR INTERNAL PIPING *(A and B above)* allow streamlined design plus the best in filtration. Flange mounting with external outlet *(C above)* and line-type *(cutaway on facing page)* are just two of many other possibilities.

MAIL COUPON FOR COMPLETE INFORMATION

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids from More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge)
FLO-KLEAN (wire-wound) • PORO-KLEAN (porous metal)

CUNO ENGINEERING CORPORATION
Department 20-11
South Vine Street, Meriden, Conn.

Please send me full data on the NEW Cuno SUPER Auto-Klean filter.

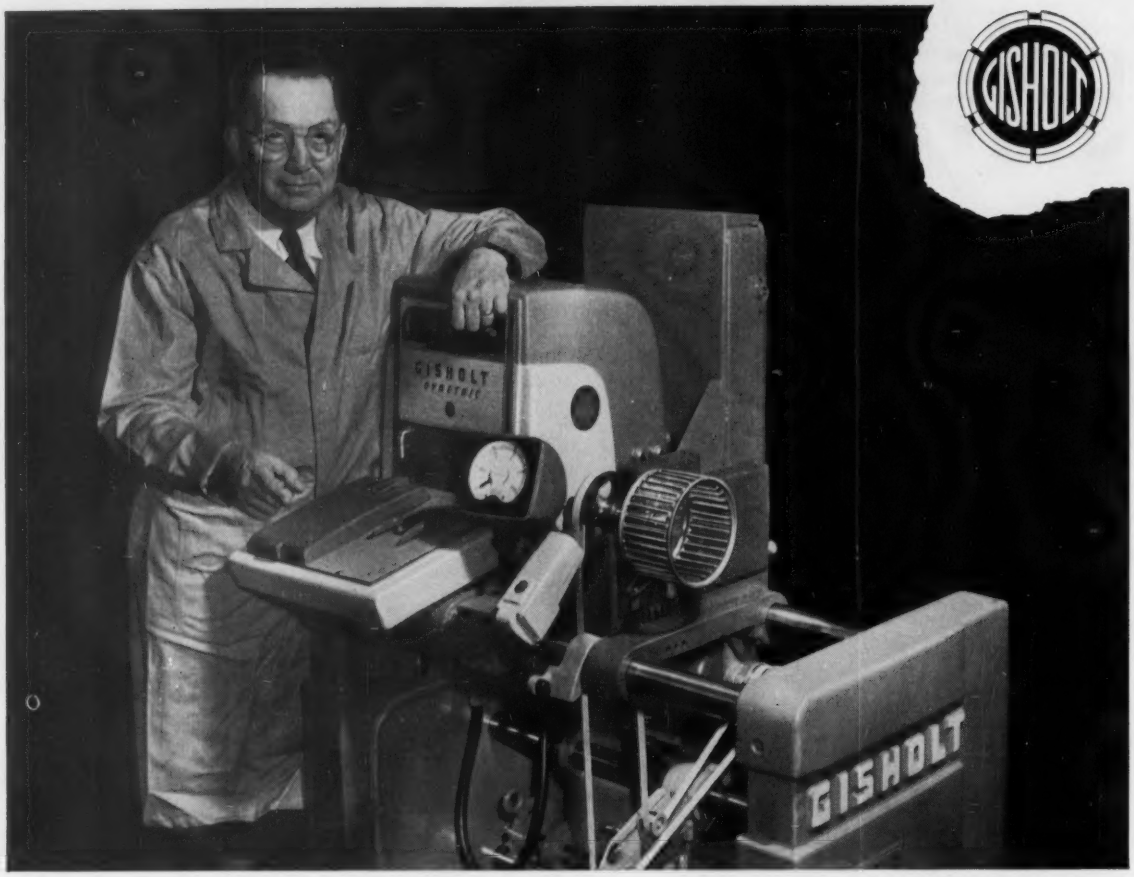
Name_____

Firm_____

Position_____

Address_____

City_____ Zone_____ State_____



GISHOLT BALANCING MACHINES
don't stop at "good enough!"

Dynamic balancing has only one purpose—to eliminate vibration. Thus, it's a precision operation, worth doing *right!* Beware of these "good enough" standards.

Gisholt Balancing Machines enable you to set the highest possible standards and achieve them in minimum time. It's because they don't limit you in accuracy. Their extreme sensitivity enables you to measure vibratory movement of at least .000025 inch. They locate and measure unbalance forces in a matter of seconds. They do it by separating—and isolating—unbalance effects in two different planes. They can provide readings directly in terms of correction units for your specific parts. These are very important in making your balancing operations more accurate and efficient.

Next time you hear "good enough" in connection with dynamic balancing, be on your guard. Compare with what Gisholt will give you in accuracy, convenience, long life, and final cost, too. These are the things that have made Gisholt the outstanding leader in balancing. Write for literature.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

DYNETRIC BALANCERS GISHOLT

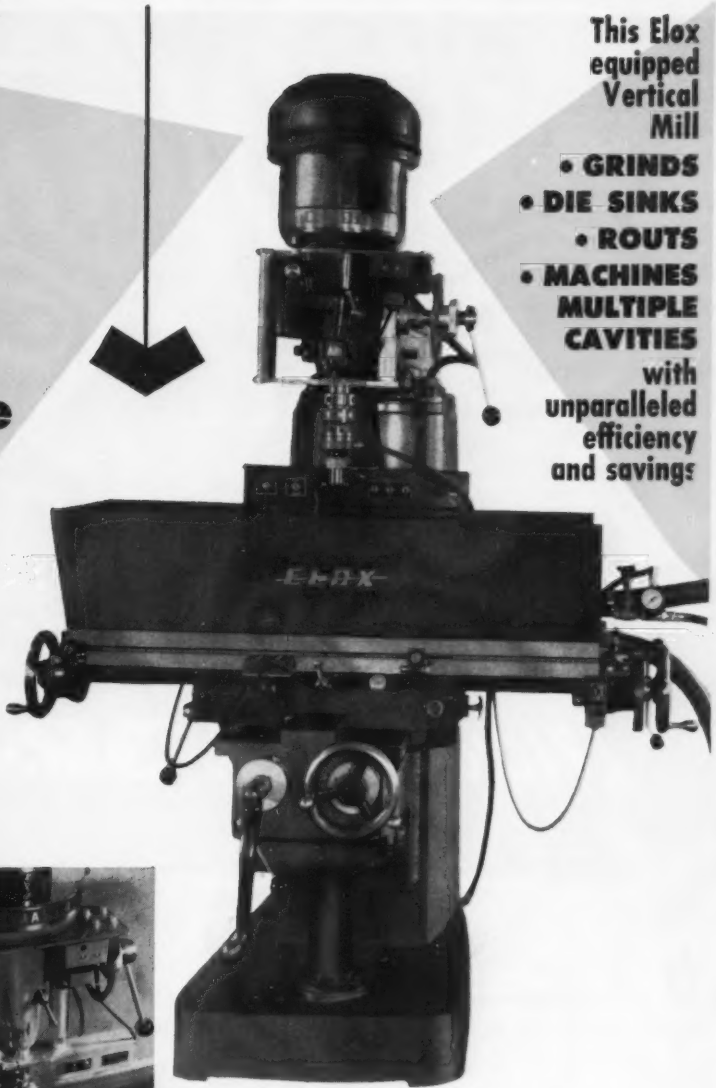
TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

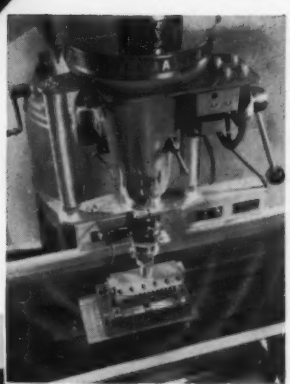
Electrical Discharge Machining produced this multiple cavity In 8 hours

conventional machining time 40 hours

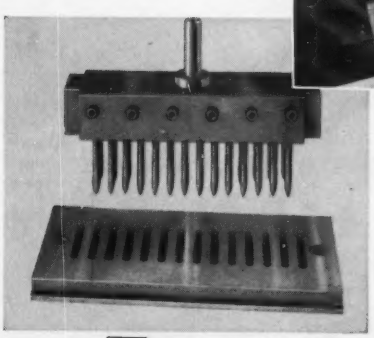
This Elox equipped Vertical Mill

- GRINDS
- DIE SINKS
- ROUTS
- MACHINES MULTIPLE CAVITIES with unparalleled efficiency and savings





Multiple Cavity in coolant retainer tank of Vertical Mill. Machined cutomatically without operator attention or broach cost.



Finished die and brass electrode. Die Material: Hi Chrome Die Steel. Tolerances: +.0005"—.000 Finish: 15-20 micro inch.

Our engineering staff is always ready to help solve your specific machining problems. Representatives in your area will arrange appointments, at your request, for grinding, die sinking and cavity forming operations at EDM Demonstration Centers.

elox corporation of michigan

742 N. ROCHESTER RD. • CLAWSON, MICHIGAN

DEMONSTRATION CENTERS:
Plant—Clawson, Mich.
45 Broad Ave., Palisades Park, N.J.
1907 W. Monterey, Chicago, Ill.

For more information on products advertised, use Inquiry Card, page 239

MORRIS AIR-OIL-MATIC DRILL UNITS

Fast, low-cost production for drilling and allied operations.

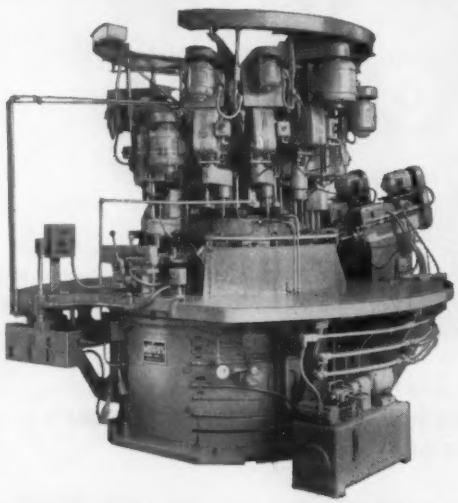
- Adjustable Feed
- Wide range of spindle speeds
- Convenient controls
- Hydraulically controlled

Available for use on Special Purpose Machines like the MORRIS High Production Machines illustrated.

MORRIS CAM-MATIC DRILL UNITS

Newly introduced, MORRIS CAM-MATIC Drill Units provide automatic, electrically controlled, mechanically driven drilling, tapping and allied operations . . with built-in accuracy, dependability and convenience. Specially-featured electric clutch provides automatic thrust control and dull or broken drill detection.

Morris MOR-SPEED



MORRIS HIGH PRODUCTION MACHINES

Special Operations with STANDARD Units

- Specialized Production
- Automatic Indexing and Positioning
- Multiple Operations
- Easy Model Changeover

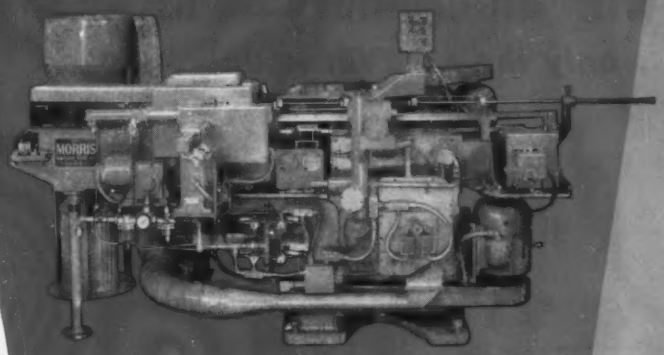
You can have swift, accurate production on multiple operations like drilling, reaming and tapping with MORRIS Mor-Speed High Production Machines. They provide special operations using standard units, with completely automatic operation. Easy re-alignment speeds model changeovers.

MORRIS MOR-SPEED RADIAL DRILLS

4 SIZES - 2 NEW UNITS
Centralized Controls

A complete line of heavy and light production radial drills feature centralized controls for ease of operation, fast production. Two new models utilize hydraulic control for push-button operation and pre-selected feeds and speeds . . . the easiest, fastest operation ever available.

MORRIS AUTOMATIC BALANCING MACHINES



all new

COMPLETELY AUTOMATIC from load to unload, these machines produce up to 720 perfectly balanced pistons every hour. Units are balanced within one gram plus or minus for extreme accuracy required in finished product.

MACHINE TOOLS

Designed for Production PLUS Precision

N E W . . . with proven performance, that's the story of these up-to-the-minute models of MORRIS Machine Tools. For more than 40 years, MORRIS has designed and manufactured high speed, precision equipment. The new models displayed on these two pages are the latest in a series of machine tools that have won the favor of the nation's leading manufacturers.

Your built-in benefit with these new MORRIS Mor-Speed Machine Tools is precise work at high speeds. Make your own comparison of MORRIS features with those of any unit. You'll see why the leaders demand MORRIS!

MORRIS MOR-SPEED MACHINE TOOLS have been selected by the world's leading manufacturers for low-cost mass production of precision-made parts and assemblies. Complete case history data is available FREE upon request.

Write today for catalogs concerning specific machines. If you prefer, outline your production problem. MORRIS engineers will make recommendations for its best solution.

Gallus MOR-SPEED Line

Morris

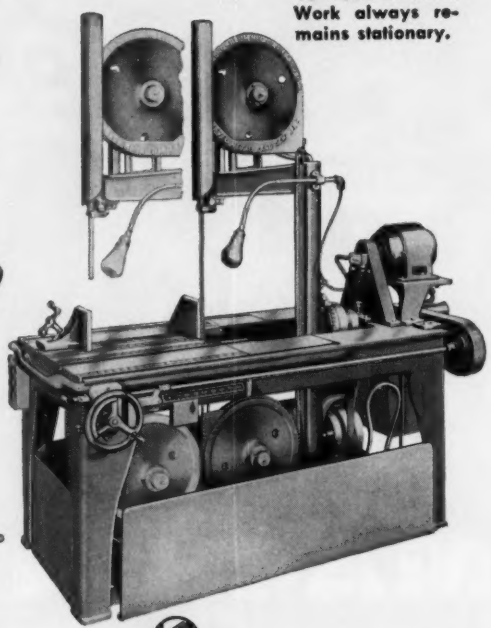
THE MORRIS MACHINE TOOL COMPANY
946 HARRIET STREET, CINCINNATI 3, OHIO, U. S. A.

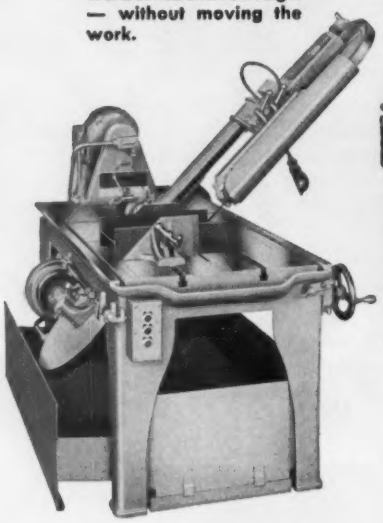
Never Confuse the No. 8 MARVEL with an ordinary Band Saw

...only the MARVEL is Universal

Only on a MARVEL No. 8 does the blade remain at a right angle throughout its full 18" feed traverse. Work always remains stationary.

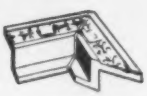
Only on a No. 8 MARVEL can the saw column be instantly indexed and locked at any angle from 45° right to 45° left, and the saw then fed thru the work at the desired angle — without moving the work.





Only a No. 8 MARVEL can do all of these things: Snip-off a ⅛" rod or cut-off an 18" x 18" cross section

Rough to Size and Shape



Miter

Index

cut off and shape Structural Beams.

Only a No. 8 MARVEL has the large T-slotted work table, with removable quick action vise, that permits accurate set-ups of work of unrestricted sizes and shapes, special fixtures; Etc.

"Rough Machine" to size and shape with minimun chip waste

The No. 8 MARVEL is the "busiest tool in the shop" wherever installed because it is a *universal* tool—has both the capacity and the versatility to handle not only standard sawing jobs but innumerable "trick" and convenience jobs as well. More than a metal saw, the No. 8 MARVEL is a fine machine tool with machine tool features like: Both power and hand feeds; Depth Stops; Automatic Blade Tension; Built-in Coolant Pump; Three operating speeds (or six with 2-speed motor). Moisture-proof electrical controls that conform to both "J.I.C." and "MACHINE TOOL" electrical standards; Dirt-proof ball bearings, etc.

If you cut, machine or fabricate metal, this is a sawing machine you should know about. Write for catalog.

MARVEL Metal Cutting SAWS

Better Machines–Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

"Economical Buying of Screw Machine Products Now Calls for Greater Care in Specifications,"

says Leonard Schaffer, President, Mechanical Art Works, Inc., Newark, New Jersey

A few typical fine-finish, close tolerance screw machine products currently produced from ANACONDA Rods at the Mechanical Art Works.

"The tremendous versatility of automation in modern manufacturing has placed a bigger burden on the designer and buyer of screw machine parts," Mr. Schaffer explains. "The trend toward miniaturization has shifted many more parts to the screw machine. And the screw machine's ability to provide *tolerances* as close as .0005", and finishes heretofore obtainable only by centerless grinding, has left a tremendously wide choice in specifications."

Mr. Schaffer, a long-time user of Anaconda products, says, "I can count on the uniform machining characteristics of ANACONDA Rods from batch to batch, which is important for both quality and economy in my business."

For complete data on composition and machinability of standard ANACONDA Alloys, standard specifications, weights and dimensions of standard rods, write for Publication B-14. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5583

A few of Mr. Schaffer's suggestions to buyers of screw machine products for keeping costs down.

Wherever possible, the largest diameter of the piece should correspond to a standard stock rod diameter.

Avoid fancy shapes calling for expensive forming tools.

Use hole diameters obtainable with standard tools.

Allow commercial tolerances if possible, otherwise specify tolerances no closer than necessary.

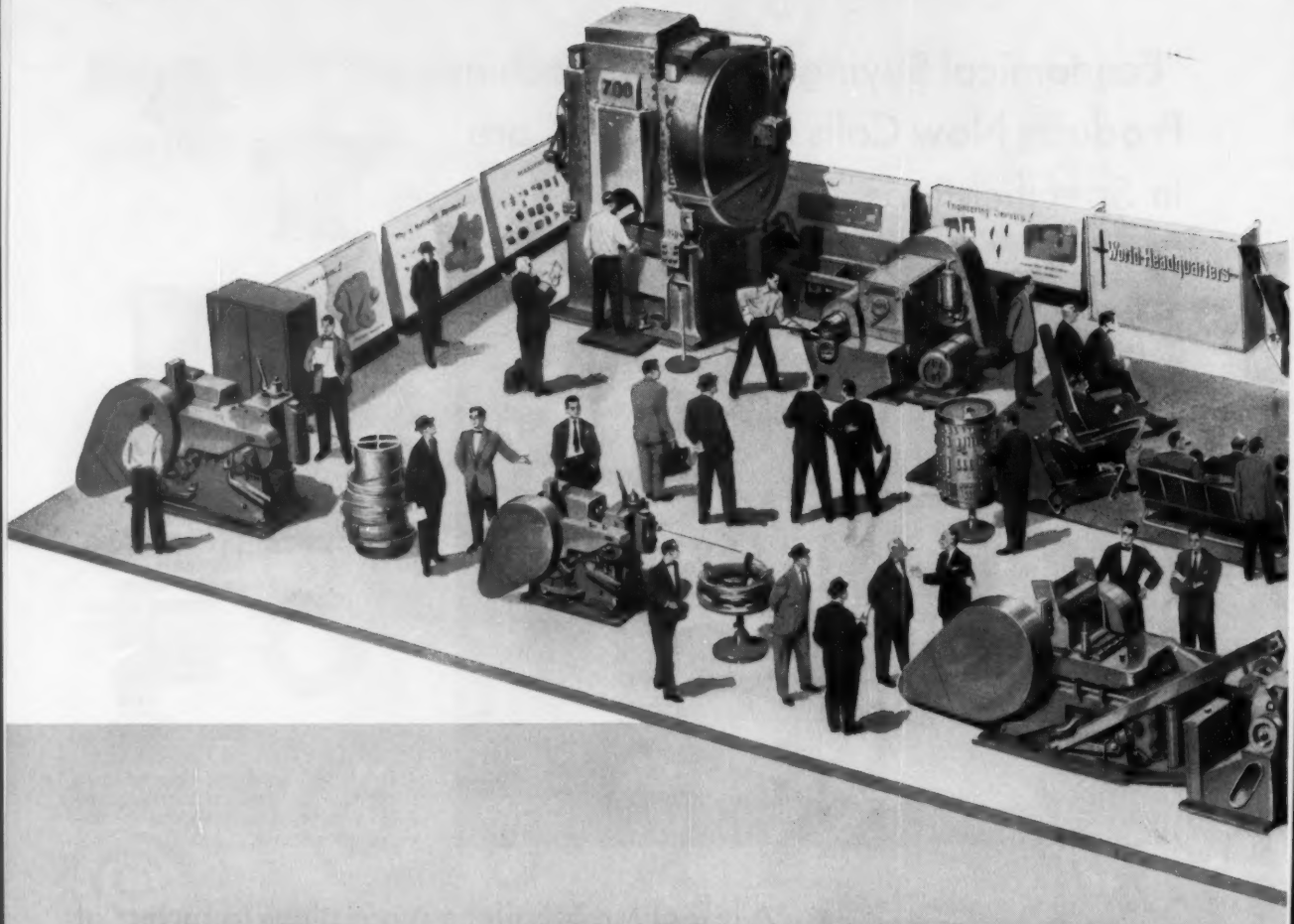
Specify Standard National Coarse or National Fine Threads wherever possible.

On external threads, cutting full threads close to a shoulder is expensive —and may be unnecessary.

Tapping blind holes close to the bottom is difficult and costly.

Specify free cutting material unless special physical properties are required, then select the best machining material containing those properties.

ANACONDA® RODS FOR SCREW MACHINE PRODUCTS



Working with You in Forging Is Our Year-Around Job!

We sincerely thank the metalworking industry for its interest in our exhibit at the Machine Tool Show in Chicago (illustration above).

More helpful to industry, however, than this exhibit of forging equipment, is National's own "show" which is going on constantly at the plant in Tiffin, Ohio.

Our entire organization and our years of experience are here to help you "flow metal"—hot or cold, automatically or manually, routine or unusual.

We would like to welcome you at our "World Headquarters for Forging Engineering"—where tomorrow's better ways of producing metal parts are already being tested today.

NATIONAL
MACHINERY COMPANY

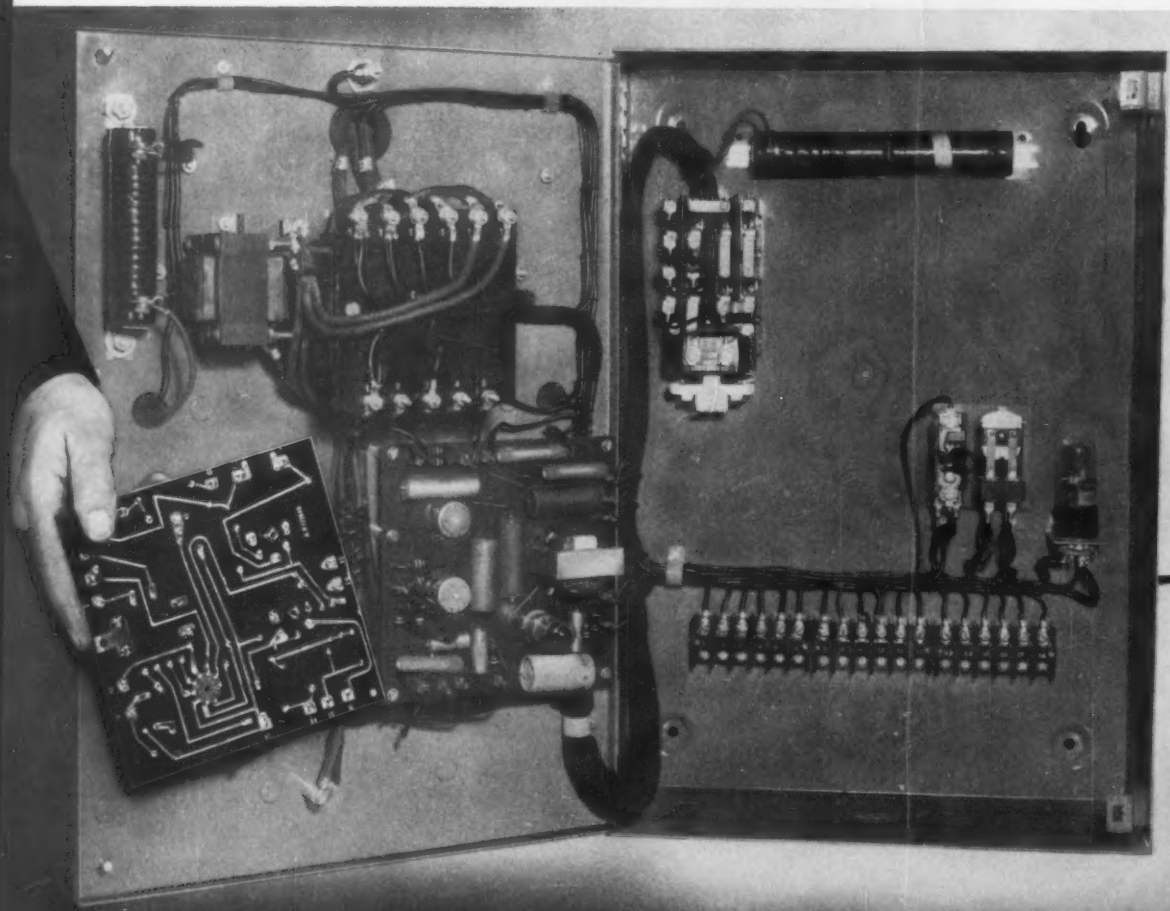
TIFFIN, OHIO — SINCE 1874

DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS • BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS

Hartford Detroit Chicago

GENERAL ELECTRIC ANNOUNCES ADDITION TO THY-MO-TROL*

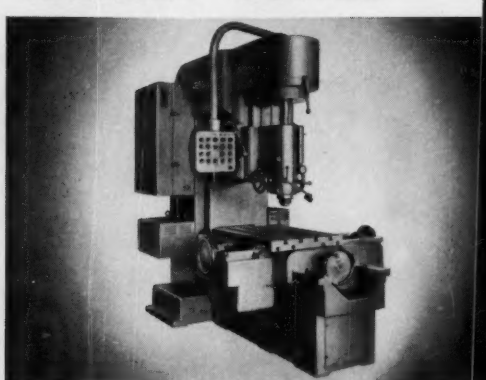
NEW Low-priced 3/4-3 HP



G-E THY-MO-TROL DRIVES ARE IDEALLY SUITED

Electronic Induction Heater. Thy-mo-trol Drive moves the carriage to exact pre-set conditions to assure uniform heat treatment.

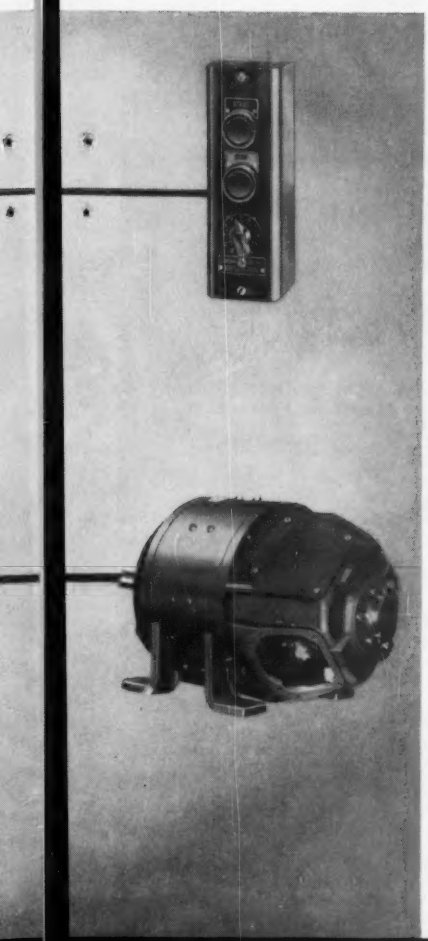
Surface Grinder. All motions on this grinding machine are controlled by General Electric's Thy-mo-trol Drive: spindle, table and cross-feed operations.



Milling Machine. Thy-mo-trol Drives automatically step up production on this milling machine by giving correct speeds for spindle, table and spindle head drive requirements.

DRIVE LINE . . .

Thy-Mo-Trol Drive with Printed Circuitry



NOW! FOR MACHINE TOOL APPLICATIONS —A RELIABLE, SIMPLIFIED, ADJUSTABLE SPEED DRIVE

These new, simplified General Purpose, 3/4-3 HP Thy-mo-trol Drives have been developed for industrial applications demanding wide speed range and close speed regulation. Embodying all the smooth adjustable speed characteristics of DC drives, the two models offer greater performance, reliable operation and wide speed range selection for many industrial applications.

A PRICE REDUCTION, due largely to G.E.'s industrial application of printed circuitry has been made. The entire control system has been simplified, giving the user substantial reductions in over-all weight, size, circuit complexity, amount of wiring, maintenance costs and installation costs.

OPERATING DIRECTLY FROM AC POWER, the new Thy-mo-trol Drives can increase machine production on most applications because they • Give the correct speed for the required operation • Reduce operating spoilage and rejects because of high accuracy performance and • Increase machine versatility because of the wide speed range and close speed regulation features offered.

THE COMPLETE THY-MO-TROL DRIVE LINE COVERS ratings from 1/40 to 30 HP and beyond. Speed ranges of 5:1, 20:1, 50:1, and 100:1 are typical. Speed regulation of ½ of 1% is possible over the entire speed range.

SIMPLIFIED FRACTIONAL HORSEPOWER THY-MO-TROL DRIVES are supplied as half-wave or full-wave units, allowing a wide selection of performance standards to meet each particular industrial application.

HIGH PERFORMANCE INTEGRAL HP THY-MO-TROL DRIVES, 3/4-30 HP, full-wave offer these superior performance features: greater flexibility, rugged industrial-type construction, easy maintenance, wide speed range, adjustable current limit, flat speed regulation and optional features such as: jogging, quick slowdown, reversing, dynamic braking, tachometer feedback and position synchronization all add up to qualify these drives for many machine tool and industrial applications.

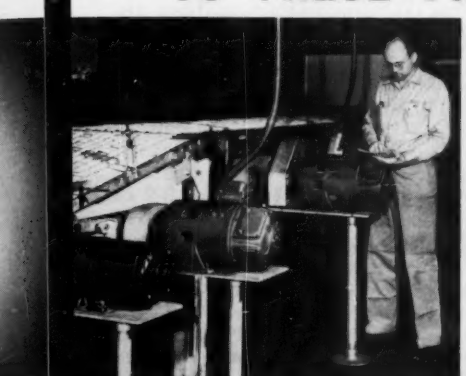
FOR MORE INFORMATION on General Electric's Thy-mo-trol electronic adjustable speed drives, contact your nearest G-E Apparatus Sales Office or write for Bulletins GEA-6234, GEA-4089, GEA-5179, GEA-5827 and GEA-5337—General Electric Company, Schenectady, N. Y. 791-2

Progress Is Our Most Important Product

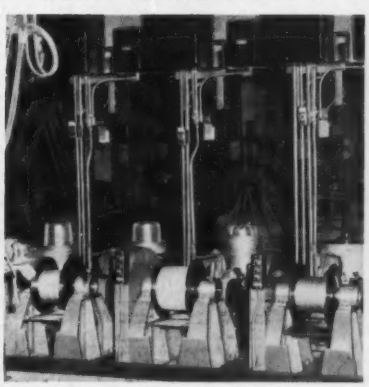
GENERAL ELECTRIC

* *Reg. Trade-mark of General Electric Company.*

TO THESE TYPICAL INDUSTRIAL APPLICATIONS



Cookie Conveyor. Repeated variations in speed—necessary to meet baking requirements—are easily handled by Thy-mo-trol Drive.



Wire Re-Winder. As the coil of wire builds up, Thy-mo-trol Drive continually adjusts speed of reel to maintain constant winding at maximum speed.

Tire-Treading Machine. A continuous strip of tire-tread passes from extruder (in background) to conveyor. Thy-mo-trol Drive synchronizes the operation.

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Macklin Co., 2925 Wildwood Ave., Jackson Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., 25 Main St. Ansonia, Conn.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Vickers Incorporated, Division of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

NEW
GREAVES
TOOLMAKERS
OVERARM

Here's the way to add new "firepower" to toolroom milling operations! Install in your toolroom a GREAVES MILL equipped with this new Toolmakers Overarm.

You'll discover new versatility for milling intricate jig and fixture work, for keywaying, slotting and angular milling. Two graduated swivels permit mounting the spindle head in almost any angle for milling, drilling, spot facing and related operations.

Powered by an independent 2 HP motor, the unit is driven through helical gears. Eight speeds may be selected with convenient controls operating speed change clutches. A hand-fed quill attachment provides 4" tool travel to the spindle. Arbor support fits overarm, permits arbor type milling without changing overarm.

Write for Complete Specifications and Prices

- Swivels permit any angular setting of spindle head.
- 2 HP independent motor drive.
- 8 speeds from 175 to 1750 RPM.
- Quill has 4" hand feed.
- Spindle equipped with No. 50 N. S. taper; reduced to No. 2 Morse taper when Quill Attachment is used.
- Gears run in oil bath.
- Full vision oil level gauge.

RACK FEED. The overarm is equipped with rack feed for positioning over work.

GREAVES MACHINE TOOL DIVISION
J. A. FAY & EGAN COMPANY
2500 Eastern Avenue, Cincinnati 2, Ohio

Manufacturers of
GREAVES MILLS
"the MOST Mill for the LEAST Money!"

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc
New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

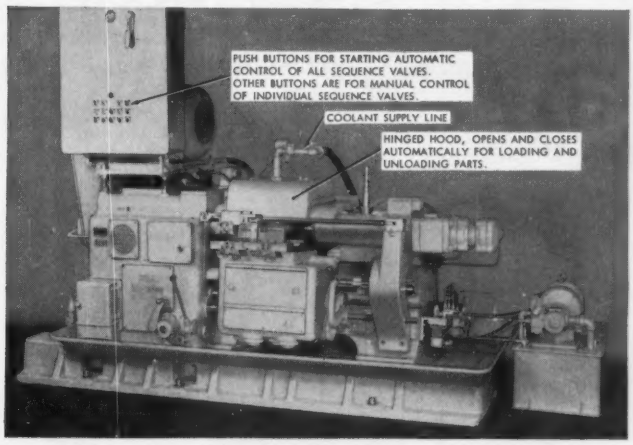
ARBORS AND MANDRELS
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., Milwaukee, Wis.
Le Count Tool Works, Inc., 390-L Capitol Ave., Hartford, Conn.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

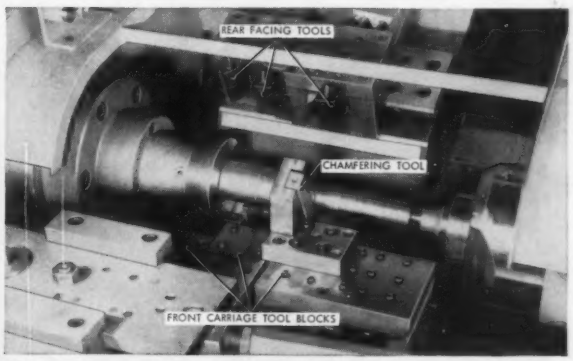
(*Continued on page* 286)

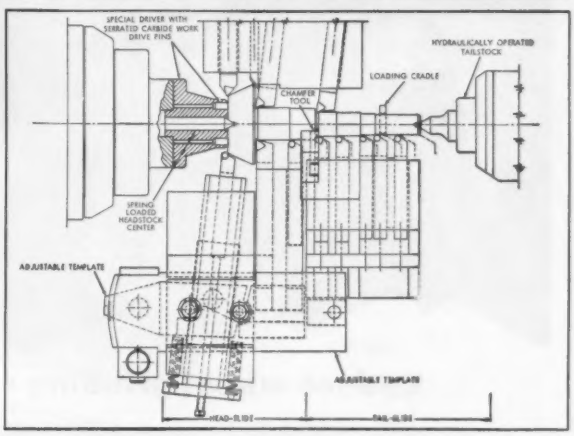
MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. **"THE Lo-swing PEOPLE"** SENECA FALLS, NEW YORK

Hinged hood in open position for loading and unloading parts ▶


PUSH BUTTONS FOR STARTING AUTOMATIC CONTROL OF ALL SEQUENCE VALVES. OTHER BUTTONS ARE FOR MANUAL CONTROL OF INDIVIDUAL SEQUENCE VALVES.
COOLANT SUPPLY LINE
HINGED HOOD, OPENS AND CLOSES AUTOMATICALLY FOR LOADING AND UNLOADING PARTS.





Lo-swing LATHE CUTS MACHINING AND HANDLING TIME ON REAR AXLE DRIVE PINIONS

PROBLEM: To finish turn (from end to end) Rear Axle Drive Pinions in one operation and to reduce handling time to a strict minimum.

SOLUTION: A Model AR Automatic Lo-swing Lathe, equipped with Automatic Controls and Serrated Pin Type Driver was selected for this job. The work piece is driven from the gear end by a special driver fitted with serrated carbide pins which indent the large face of the gear. Indentation is obtained by pressure from the tailstock center which is mounted in a hydraulically operated quill. Two pressures, automatically controlled, are used...a high pressure for forming the indent while the shaft is being loaded between centers and a low pressure during the actual machining operation.

This method of driving the work piece permits the machining of all of the gear and stem diameters as well as the facing and undercutting of shoulders in a single operation. Eight carbide front turning tools, one of which is template operated, reduces the length of cut to 2-3/16". This is the length of cut required for the bearing nearest to the bevel gear. The facing, undercutting and chamfering of shoulders are accomplished with four carbide tools mounted on the rear slide. It should be noted that the template is adjustable to handle bevel gears having different angles.

Handling time and operator fatigue are held to a strict minimum by the use of a loading cradle and automatic controls for placing the part between centers, and opening and closing the hinged hood.

The machine stops at the end of the cycle with the spindle stopped, tailstock center retracted, hinged hood open and with the machined part dropped into the cradle. The operator simply replaces the finished part with a rough forging and then pushes two starting buttons, energizing the loader controls, which consecutively close the hood, place the work between centers, indent for the driver pins and finally start spindle rotation. The automatic cycle from then on is controlled by the automatic camming built into the base machine.

The tooling area of the machine is entirely enclosed to protect the operator from flying chips and coolant while cutting at high spindle speeds. Two starting buttons, wired in series, require the operator to use both hands. They are so located that the operator is out of range of the closing hood, thereby preventing accidents.

Control buttons on the door of the starter panel permit normal operation of individual controls and are convenient for setting up and timing loader movements.

Seneca Falls engineering staff is at your disposal to help solve your production problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

Christensen diamond tools at FORMSPRAG

Reduce wheel grinding costs...

Mass precision grinding performed at the Formsprag Company of Van Dyke, Michigan in the manufacture of clutches requires low cost mass precision wheel dressing. That is why economy-minded engineers at Formsprag look for the tool with the long-lived precision dress—a Christensen diamond tool. Christensen diamond tools are set with first-quality stones to give longer, more accurate, lower-cost service. The tool shown above, Type T-7155, used on a Heald Internal Grinder, cut diamond tool cost 50%.

At left is the Christensen Type T-725 single stone, large head wheel dressing tool for use as a general purpose tool for straight or form dressing on centerless, cylindrical, surface and other grinders in general use. It is a practical tool to use in the shop where usage is low or where a diamond tool is issued to each individual operator.

There is a Christensen diamond tool that can help reduce your dressing costs. Call a Christensen man or write for our catalog No. 700.

tool division

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST SALT LAKE CITY, UTAH

BABBITT
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Olsen, Tinius, Testing Mch. Co., Willow Grove, Pa.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mich. Tool Co., 2531 11th St., Rockford, Ill.

BALL BEARING TESTERS
Micrometrical Mfg. Co., 321 S. Main St., Ann Arbor, Mich.

BALLS
Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

BARS, Steel
Allegheney Ludlum Steel Corp., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded
Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

BEARINGS, Babbitt
Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.

BEARINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

(*Continued on page* 290)

KEMPSMITH MASTER-MILL

It's **NEW**
It's **MODERN**

The Hit of the Show at Chicago!

The enthusiastic reception accorded the new Kempsmith MASTER-MILL at the Machine Tool Show is now history. Thousands of production-minded visitors witnessed the demonstration of this modern milling machine. They agreed, the Kempsmith MASTER-MILL is the finest, most efficient, most productive milling machine of its size and horsepower on the market today, regardless of price. It cuts milling costs to rock bottom by fully utilizing modern cutting tools and techniques. Conveniently located controls permit more rapid set-ups, thereby providing more cutting time. Low initial cost, plus economy of operation, assure highest return on investment. Now available in sizes No. 2 and No. 3—Plain and Universal models. For descriptive literature on these modern milling machines write:

KEMPSMITH MACHINE CO., 1821 So. 71st St. Milwaukee 14, Wis., U.S.A.

Precision-Built MILLING MACHINES Since 1888!

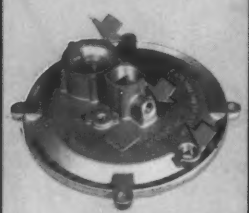
A 8501-1PC

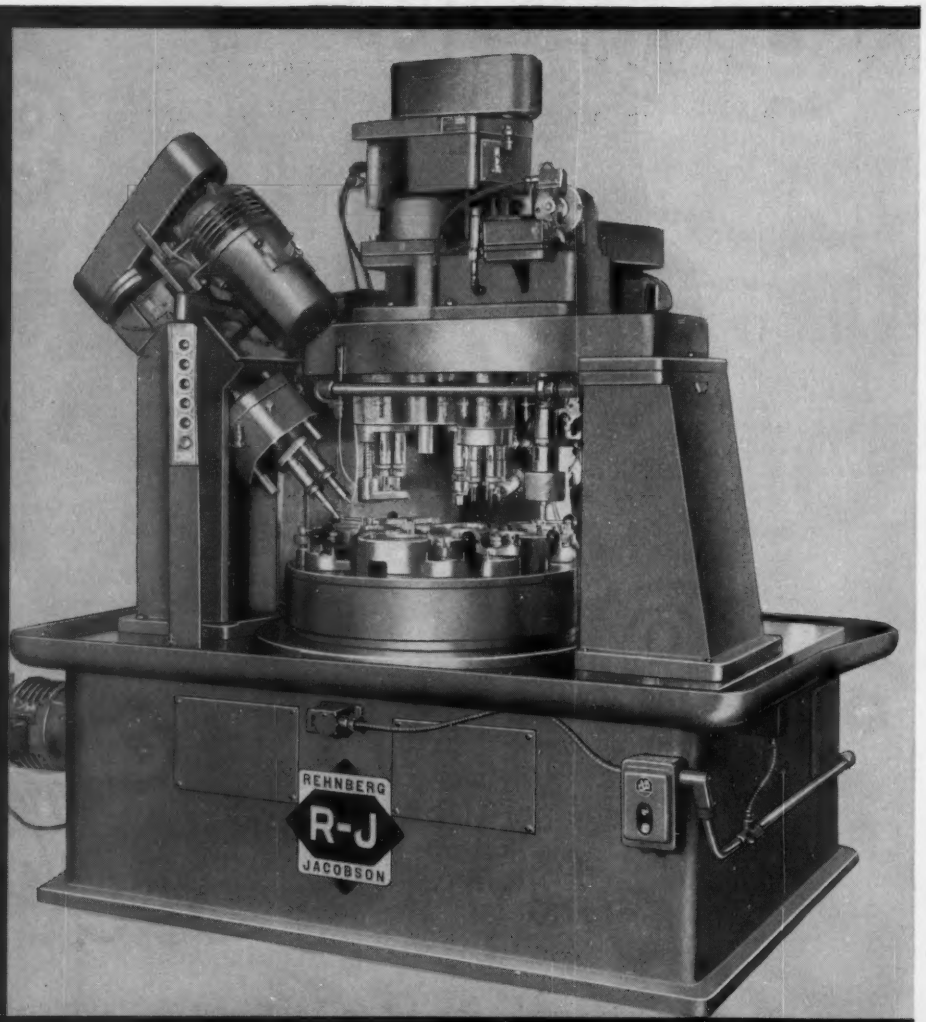
SCULLY JONES

"Precision Holding" saves tooling problems on

Performs 15 operations at 75 to 80% less cost

Machining costs were reduced 75 to 80 per cent by this special four-station automatic index machine, designed to perform 15 operations on two sides of air brake end plates. On the smaller piece, five holes are drilled and tapped; one angular hole is reamed and its face is circular serrated; another angular surface is faced; and the interior of the housing is faced and reamed. Larger piece also machined is similar but with only one angular surface and the addition of a pipe thread.





Rehnberg-Jacobson specifies Scully-Jones Spindle Extension Assemblies, Floating Holders, and Tap Chucks

Rehnberg-Jacobson Manufacturing Company, Rockford, Ill., designed this special four-station automatic index drilling, reaming, tapping, facing, and serrating machine for a large manufacturer of air brakes. Machine has one loading position and three working positions. Work is clamped manually in simple locating fixtures, which are changed easily to accommodate two sizes and different operations required on partially finished aluminum die castings. Scully-Jones Spindle Extension Assemblies, Floating Holders, and Tap Chucks were specified to simplify tooling changes, eliminate breakage, and maintain the accuracy built in the machine.

time and money, solves diversified spindle-type machine tools!

It pays to specify Scully-Jones "Precision Holding" to solve tooling problems and properly adapt cutting tools to the machine and the job. Here are three of more than 50 different "precision holding" tools that simplify operations, reduce downtime, and improve production.

The Style "JA" Floating Holder gives you extra protection against tool breakage and inaccuracies due to misalignment because there can be no binding or "dead spots" in the action of the collet. Its exclusive double gear spline drive principle assures unrestricted float, difficult or impossible to achieve with other holders on the market.

To convert multiple spindles and adapt tooling for a variety of operations, Scully-Jones Spindle Extension Assemblies are available in both small and large body diameters. These units accommodate tooling which requires a wide range of inside tapers and body lengths to extend or alter machine spindles. The Quick-Lock Nut permits fast, accurate adjustment in the spindles or pre-setting outside the machine. New "keyhole"-type drift slot accommodates both "keyhole"- and cam-type tool ejectors.

Style "A" Tap Chucks, with four-slot design, provide up to four times greater holding power on the tap shank, increase resistance to pull-out, and reduce tool breakage. Chuck closes evenly on all sides and along the length of the tap shank, assuring accurate operations.

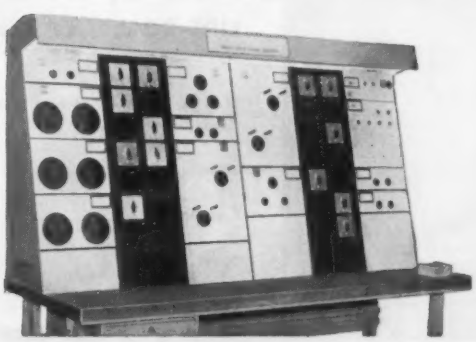
Call your Scully-Jones factory-trained representative or distributor, today.

SCULLY JONES

Scully-Jones and Company, 1906 So. Rockwell St., Chicago 8, Ill.

Scully-Jones "TOOLITROL" Boards and Gages

Reduce setup time, downtime, inspection time, and keep multiple-spindle machine tools operating at maximum capacity with Scully-Jones "Toolitrol" boards and gages. Scully-Jones engineers, with a complete line of holding and driving tools to choose from, can help you plan and design a completely integrated tool control method and solve at-the-machine problems of pre-setting, storing, and changing tools. For complete information, write for Bulletin No. 19-50.



For more information on products advertised, use Inquiry Card, page 239

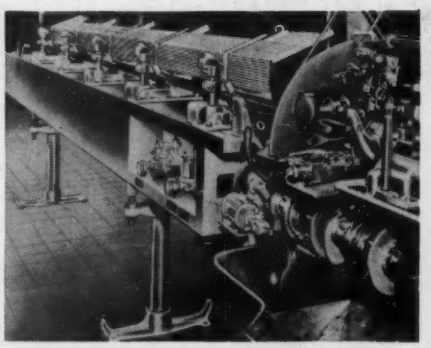
Why let the 4th DIMENSION limit your machine tool output?

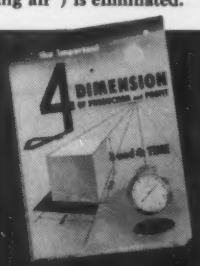
A trip to the washroom or tool crib, a halt for feed finger repair, a spinning empty chuck—these interruptions to the steady flow of production can never be made up . . . for TIME, the 4th Dimension, waits for neither man nor machine.

Over 150 firms have learned how to use every minute of every shift for continuous, 4th Dimension production. Here's how . . .

Lipe A.M.L. Bar Feed Eliminates Time Losses, Increases Output 30% or More

The Lipe Automatic Magazine-Loading Bar Feed is an air-operated attachment which holds an 8-hour supply of bar, rod or tubing and feeds it continuously to any machine equipped with a fixed stop. There are no feed fingers to break down—nothing to scratch or mar polished stock. It will feed any length in one feed-out, thereby cutting cycle time. Remnants are ejected automatically. Idle operation ("cutting air") is eliminated.





Send for this free book: Shows how to convert your machine tools to 4th Dimension Production.

LIPE-ROLLWAY CORPORATION
Syracuse 4, N.Y.

Send me free book on how to gear machine tools to the steady flow of Time.

Name ..... Title .....

Company .....

Street .....

City ..... Zone ..... State .....

BEARINGS, Lineshaft
Fafnir Bearing Co., New Britain, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle
Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Self Lubricating (Oilness)
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.

BEARINGS, Tapered Roller
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BELT SHIFTERS
Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, Transmission
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

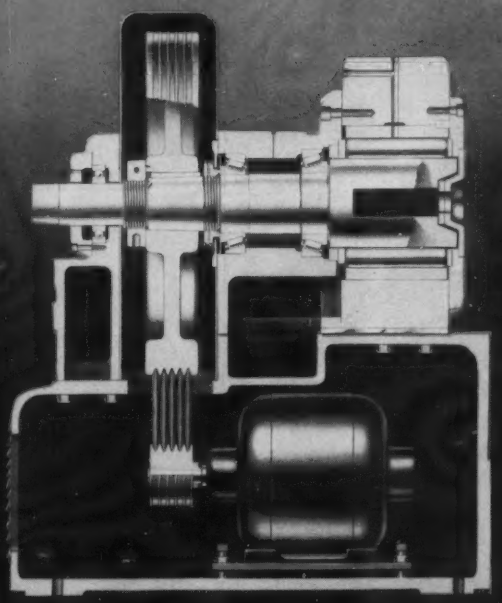
BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.
Consolidated Mch. Tool Corp., 656 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.

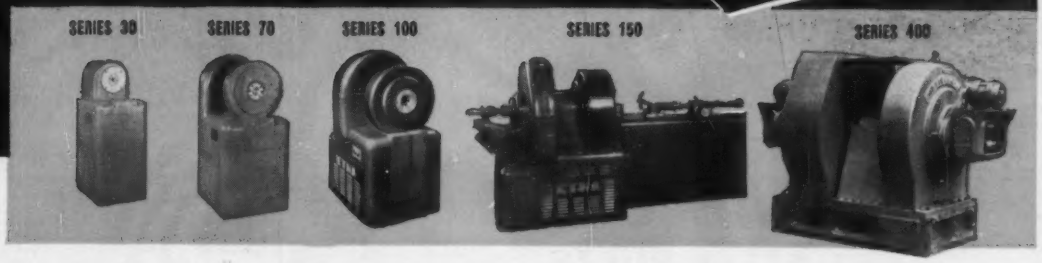
(*Continued on page* 292)

IF IT'S SWAGING... It's Etna..

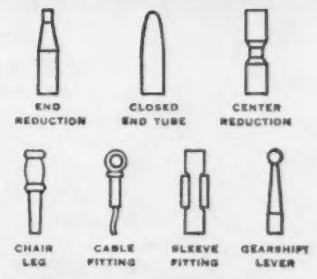
FOR CONTINUOUS PRECISION PRODUCTION!



A COMPLETE RANGE OF SIZES AND CAPACITIES



For tapering, sizing, reducing and forming to special shapes of round solids and steel tubing, the Etna Swaging Machine offers the ultimate in modern machine design. Regardless of size and description of the job to be done, there's an Etna swager right for *greater production*. Write today regarding your specific job problems.



It's New! Get full information on the blending into the wall of I. D. Bead on steel and stainless steel tube with Etna Swagers resulting in mirror finish. Bead also removed on conduit.

Abbey ETNA Company

3422 MAPLEWOOD AVE., TOLEDO 10, OHIO

EASY to READ in any light —
reduce errors, speed up readings.

RESIST RUST and STAINS —
from oils, acids, perspiration.

WEAR LONGER —
multiple electroplatings protect markings, resist abrasion.

LUFKIN

CHROME CLAD
STEEL RULES

Ask your industrial distributor to show you the new Lufkin machine divided Steel Rules with the famous Chrome Clad finish. Jet black "rapid reading" markings stand out sharp and clear against the hard chrome white background. Available with all popular graduations and in all popular lengths — both full flexible and spring tempered.

BUY LUFKIN TAPES • RULES • PRECISION TOOLS FROM YOUR DISTRIBUTOR

THE LUFKIN RULE COMPANY, SAGINAW, MICH.
132-138 Lafayette St. New York City
Barrie, Ont.

372

SAVE TIME

CONSULT YOUR INDUSTRIAL DISTRIBUTOR

- He can supply most items immediately from his stock.
- His knowledge of new tools and methods will help you operate at peak efficiency.

BENDING MACHINES, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.

BLAST CLEANING EQUIPMENT
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagestown, Md.
Wells Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BLUING LAYOUT
Dykem Co., 2303P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOOKS, Technical
Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES
Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio

(*Continued on page* 296)

SIMONDS CROSS-ROLLED STEEL

Makes a Simonds hacksaw blade last longer!

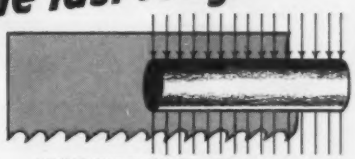
Look for... ask for the blade with the "RED END"

Test after test proves that Simonds "Red End" Hack Saw Blades last uniformly longer. One reason is Simonds *cross-rolled steel* . . . steel that has a more uniform grain structure for added toughness.

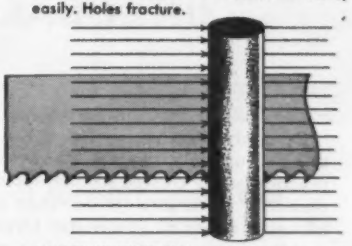
Another reason is Simonds own high quality steel — made especially for hack saw blade use.

Add to this Simonds improved method of tooth setting . . . and Simonds more uniform heat treating . . . and you've got the reasons why Simonds "Red End" Hack Saw Blades last longer, give more cuts per blade, cost less to operate.

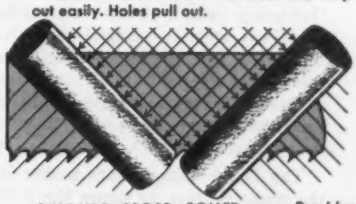
Furnished in all standard lengths and tooth sizes for hand and power use with a choice of High Speed MOLYBDENUM; High Speed TUNGSTEN; WELD-EDGE (High Speed Shatterproof); and STANDARD STEEL (Hand Blades only).



ROLLED WIDTH-WISE — Blade tends to snap easily. Holes fracture.



ROLLED LENGTHWISE — Teeth tend to strip out easily. Holes pull out.



SIMONDS CROSS-ROLLED — Provides toughest grain structure for longest life and resistance to breakage.

For Fast Service from Complete Stocks

Call your

SIMONDS Industrial Supply DISTRIBUTOR

SIMONDS SAW AND STEEL CO.

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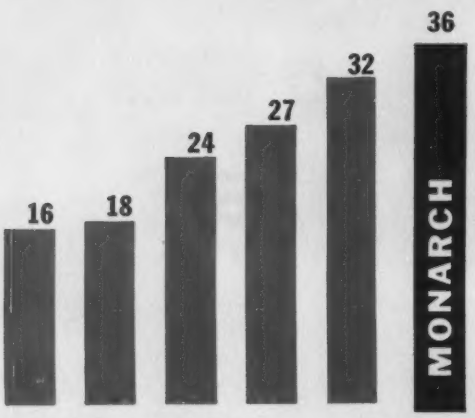
Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon
Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.
Heller Tool Co., Newcomerstown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

For more information on products advertised, use Inquiry Card, page 239

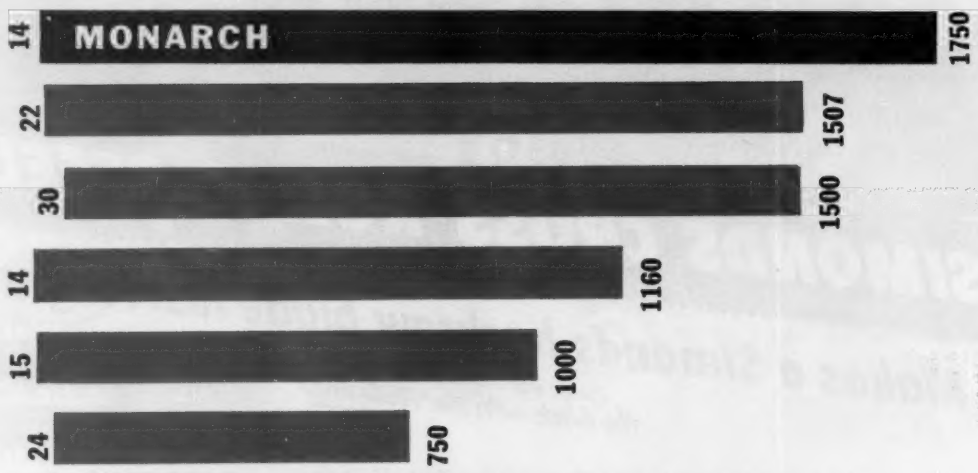
TALK ABOUT SPEEDS!

There's No Matching the Monarch Preselector Dyna-Shift



THE MOST SPEEDS–36

Unique Speed PRESELECTOR DYNA-SHIFT



UNEQUALED RANGE–14 to 1750

Surface Cutting Speed! These three words are the key to top efficiency in the operation of *any* lathe.

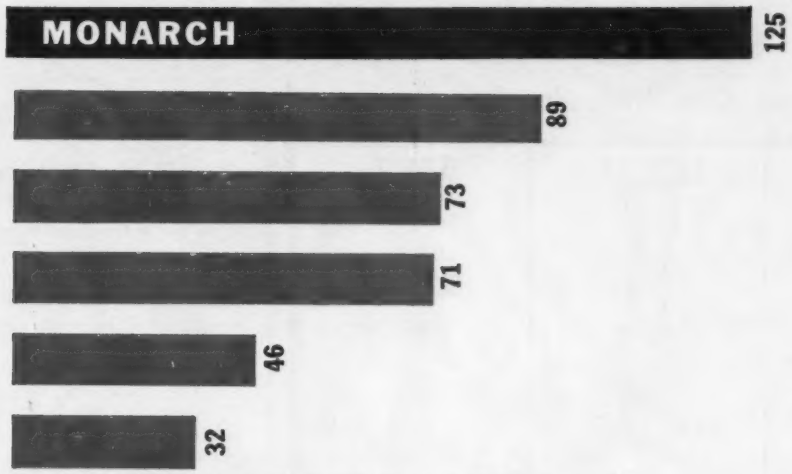
Certainly it's true, you say. But why bring that up? Because only now is a lathe available to give you, practically the correct surface speed, diameter after diameter, piece after piece. That lathe is the new Monarch Series 62 Preselector Dyna-Shift.

It has 36 speeds in a range of 14 to 1750 RPM. Headstock ratio is 125 to 1. And it has *speed preselection.* Here at last is a machine with a standard speed range low enough, high enough and with plenty of speeds in between to make unnecessary a whole assortment of special ranges. With this one standard range you have the power to turn efficiently any part within the work capacity of the lathe.

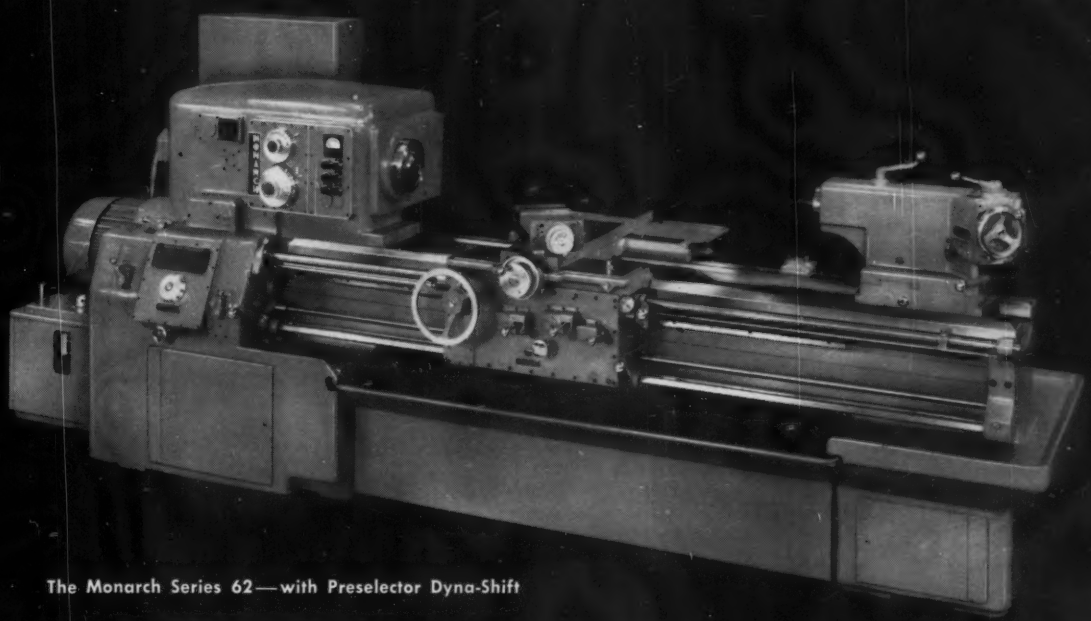
The Dyna-Shift feature makes it unnecessary for the operator ever to figure the R.P.M. he needs for the desired surface speed. He never has to be a calculating machine. He never has to get bleary-eyed figuring a lever setting combination from a complex index plate. He never has to be a color matcher. He never has to set a series of levers in a variety of positions as indicated by the index plate.

All he does is set two large dials on the Preselector Dyna-Shift—one for the work diameter to be turned, the other for the surface speed needed. The machine calculates the necessary R.P.M. and makes the shift automatically. With the preselection feature he may preset up to 6 or more different diameters and set up the shift for each while the machine is turning the previous diameter.

Nowhere but on the Monarch Series 62 Preselector Dyna-Shift can you get this combination. And no other machine can be kept under full load during the entire machining cycle for the utmost in metal removing efficiency. There's an area of cost reduction you cannot afford to overlook any longer. Ask us about it. ***The Monarch Machine Tool Co., Sidney, Ohio.***



GREATEST RATIO—125 to 1



The Monarch Series 62—with Preselector Dyna-Shift

PRODUCTION PLUS

The Monarch Series 62

Increases Productivity up to 25%*
Increases Tool Life up to 50%*

**Figures based on studies comparing step shaft output of Preselector Dyna-Shift with that of a conventional 16-speed headstock lathe.*

Monarch
TURNING MACHINES

THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio

Gentlemen:

☐ I am interested in your Series 62 story. Please send me your illustrated Booklet #1505 with complete data.

☐ Please have a Monarch sales engineer call on me.

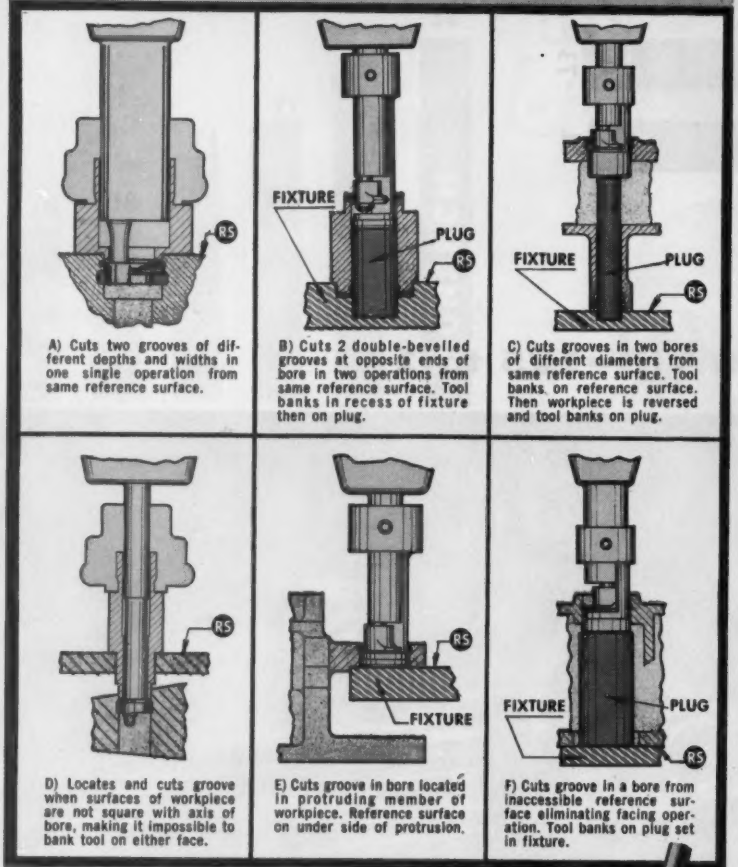
NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

Amazingly versatile! Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

Wide Cutting Range! The Waldes Truarc Grooving Tool comes in 5 models...enabling you to cut accurate grooves in housings with diameters from .250 to 5.00 inches.

Send Your Problems to Waldes! Send us your blueprints...let Waldes Truarc Engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job. There is no obligation!

Write NOW for a 20-page manual containing full information on Waldes Truarc Grooving Tool

WALDES TRUARC® GROOVING TOOL

Made by the Manufacturers of Waldes Truarc Retaining Rings
WALDES KOHINOOR, INC., 47-16 Austel Place, L. I. C. 1, N. Y.
Waldes Truarc Grooving Tool Manufactured Under U. S. Pat. 2,411,426

M117

Waldes Kohinoor, Inc., 47-16 Austel Pl., L.I.C. 1, N. Y.

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool. (GT-2-53)

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING AND TURNING MILLS, Vertical

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

BORING BARS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING, DRILLING AND MILLING MACHINES, Horizontal

(Floor, Planer or Table Types)

Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Innocenti Corp., 43 W. 61st St., New York 23, N. Y.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Portage Machine Co., 1069 Sweitzer Ave., Akron 11, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

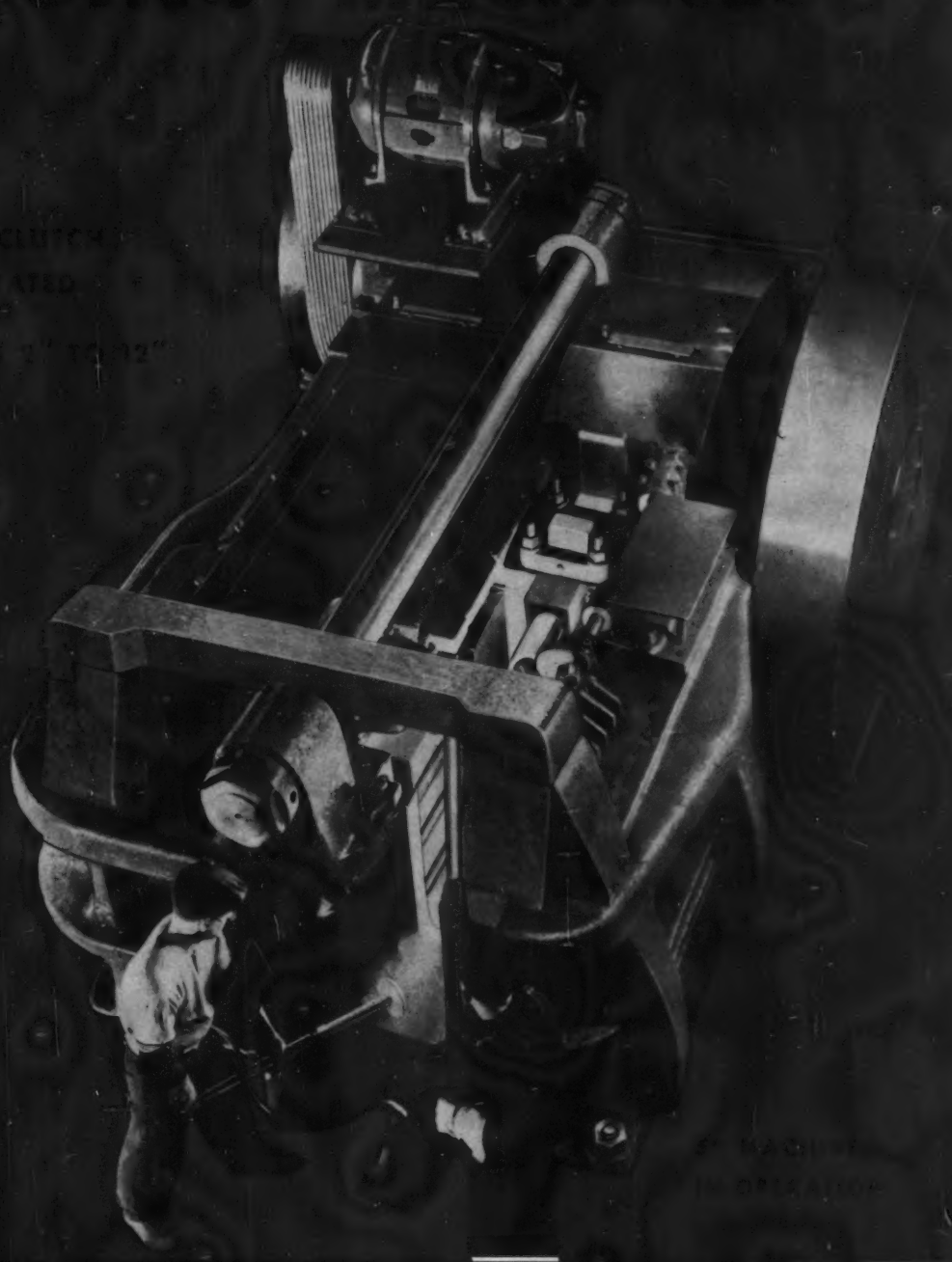
BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.

(*Continued on page* 300)

AJAX

FORGING MACHINES



THE AJAX MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND 17, OHIO

110 S. DEARBORN ST., CHICAGO 3, ILL. • DEWART BLDG. NEW LONDON, CONN.

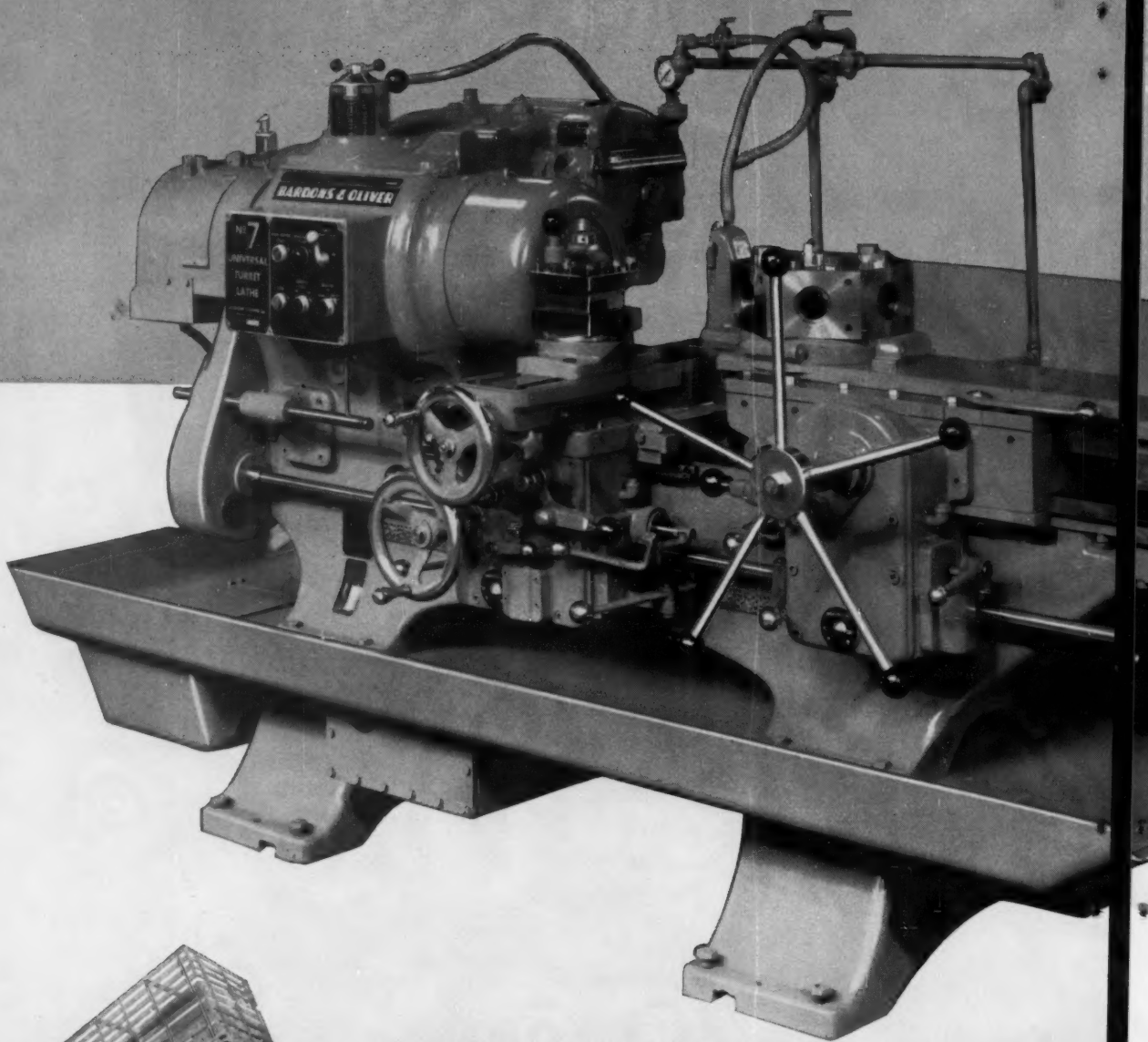
W. P. WOOLDRIDGE CO.

1209 BURLINGAME AVE., BURLINGAME, CAL. • 6440 FLEET ST., LOS ANGELES 22, CAL.

Two No. 7 BARDONS & OLIVER

(4½" CAPACITY)

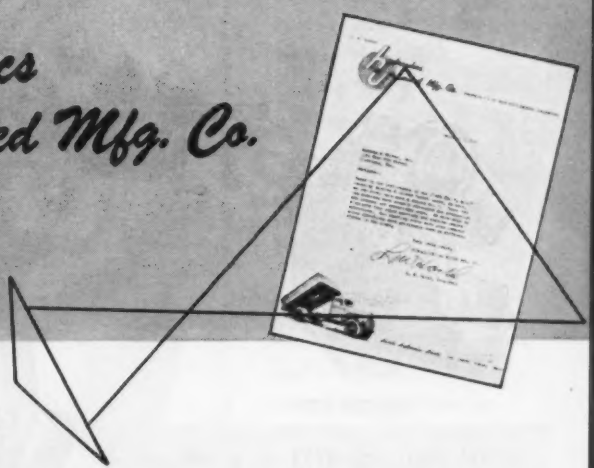
4 other machines . . . and . . .



Hydraulics Unlimited Mfg. Co., Eaton, Colorado, are manufacturers of Hydraulic Hoists for trucks, pickups and trailers.

TURRET LATHES Eliminate combine 12 operations . . . at . . .

Hydraulics Unlimited Mfg. Co.



Bardons & Oliver, Inc.
1133 West 9th Street
Cleveland, Ohio

Gentlemen:

Based on the performance of our first No. 7, 4½" capacity Bardons & Oliver Turret Lathe, we have, as you know, purchased a second No. 7. These two new machines have greatly increased our production and lowered our operational cost. We were able to eliminate four other machines and combine twelve operations. Our handling costs were also lowered since operations were previously done in different places in the plant.

Very truly yours,

Hydraulics Unlimited Mfg. Co.

L. W. Harsh

L. W. Harsh, President

MANUFACTURERS OF TURRET LATHES AND CUTTING-OFF LATHES

BARDONS & OLIVER, INC.

1135 WEST 9TH STREET • CLEVELAND 13, OHIO

Point the Way to

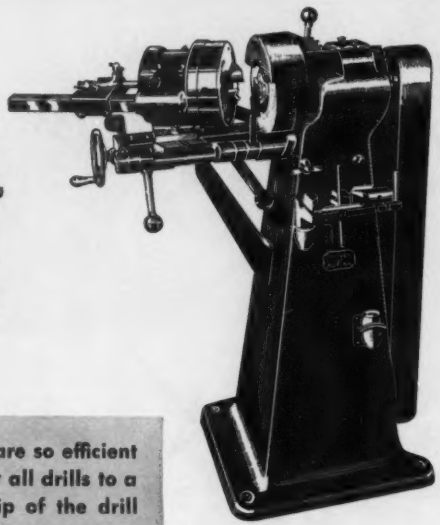
LONGER LIFE FOR YOUR DRILLS

with

OLIVER DRILL POINTERS

Twist drills machine-ground the Oliver Way not only last up to 3 times longer than hand-ground drills but also cut faster and more accurately.

MODEL #21



MODEL #510

OLIVER DRILL POINTERS are so efficient that they grind uniformly all drills to a perfect balance—each lip of the drill doing equal work. This great accomplishment is due to a unique OLIVER feature—the ability to give you the only scientifically correct and theoretically perfect drill point.

Longer wearing life for drills assures economy and efficiency. Remove your drills at the first sign of dullness . . . machine-grind them with OLIVER DRILL POINTERS and—

- **Eliminate** imperfect holes and rejects.
- **Minimize** drill costs.
- **Maintain** production schedules with assurance.

No. 510 for drills ¼" to 3"—2-3-4 flute. Variable clearances. Variable point angles. Automatic operation.
No. 21 Oliver Bench Grinder. Hand operated for Drills No. 57 to ½". Right hand, with an improved point. Attachments are available for grinding oil hole drills, left hand and other special points.

Write for our free Booklet
"How To Produce More Holes With Your Drills!"
See our catalog in Sweet's Directory

OLIVER INSTRUMENT CO.
1410 E. MAUMEE • ADRIAN, MICHIGAN

MACHINE TOOLS by OLIVER include:
AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS
DRILL POINT THINNERS
TEMPLATE TOOL GRINDERS
FACE MILL GRINDERS
DIE MAKING MACHINES

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Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Bryant Chucking Grinder Co., Springfield, Vt.
Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING TOOLS

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth-Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York., N. Y.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bliss, E. W., Co., 1375 Raff Road, S. W. Canton, Ohio.
Cincinnati Shaper Co. Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

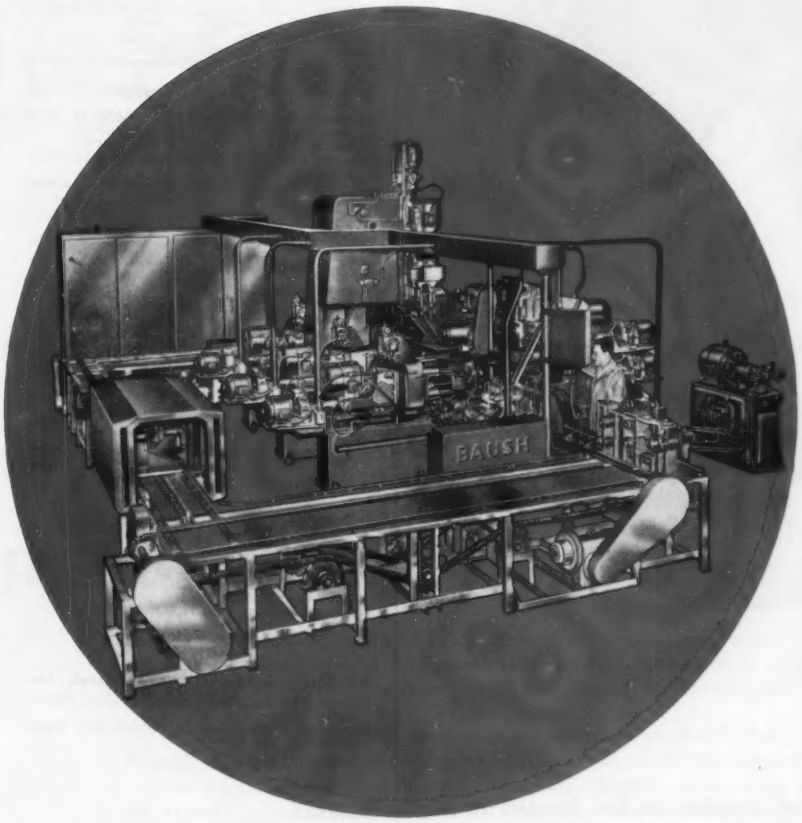
(*Continued on page* 302)

For more information on products advertised, use Inquiry Card, page 239

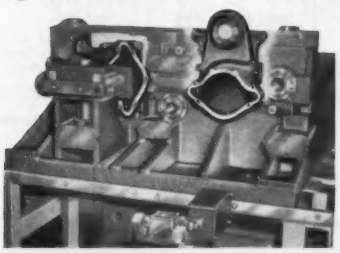
Your Production can be Increased with

BAUSH AUTOMATIC

Multi-Spindle Machine Tools



The Transfer is made up with — 5 Horizontal Model "S" mechanical leadscrew units, one of which is arranged with swivel to raise milling cutter from work • 1 Vertical Model "S" mechanical leadscrew unit • 2 Horizontal hydraulic units • 8 Fixed center heads with a total of 39 spindles • Single bar transfer mechanism • 5 Holding pallets with part held in 2 positions • Pallet conveyor • Electrical controls to J.I.C. Standards • 18 Motors



Automatic machines similar to the one illustrated more than pay for themselves through increased production at lower cost and with far less "down time" resulting from change overs, maintenance, etc.

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Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

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Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Detroit, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Shearcut Tool Co., Reseda, Cal.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
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Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.
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Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

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Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

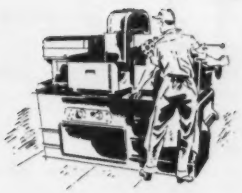
BURS

See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Kennametal, Inc., Latrobe, Pa.

(*Continued on page* 304)



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"The shop management was astounded at the results," continues Mr. Rensink. "They got an increase of 9% in production, with better finish and *without sacrifice of tool life*. Cutting fluid costs were reduced 75%. An additional plus – more effective washing resulted in selling their scrap and shavings at a premium price, where before they had trouble selling it at all! The upshot was that they switched over the entire plant to Sinclair products."

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Y Model Motorized Hardness Tester

Requires fewer operating steps... *Because*

IT'S MOTORIZED

• Here is the motorized operating procedure made possible by the new WILSON "Rockwell" Y Model Motorized Hardness Tester—

1 Place specimen upon anvil or table.

2 Elevate test piece into test position. (With the new Set-O-Matic Dial Gauge, the large pointer will then automatically point to zero.)

3 Tap depressor bar to apply Major Load. When Major Load is fully applied, the Motorized Mechanism takes over—completes the test cycle—removes the Major Load.

4 Read "Rockwell" Hardness Number. Then, lower elevating screw to remove test piece.

For complete information about the WILSON Y Model, or any others of the complete line of WILSON "Rockwell" Hardness Testers, write or call today. A WILSON hardness testing expert is available to consult on your specific requirement.

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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
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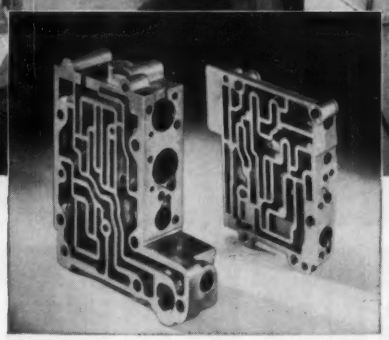
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jarvis Corp., Middletown, Conn.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Corp., 1340 W. Vernon Hwy., Detroit 1, Mich.

CASEHARDENING FURNACES

See Furnaces, Heat-Treating

(*Continued on page* 306)



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This aluminum die casting is processed in its entirety by Zagar planning, except for milling two faces. Two lines of Zagar standardized self-clamping drill jigs ream, tap and drill both valve body and cover. With 24 heads and 24 fixtures, Zagar performs work on 51 holes on close centers. Step tools take care of reaming and burnishing. The fixtures were designed to compensate for slight inaccuracies in the die casting. Thus has Zagar engineering solved an acute problem of limited production without the purchase of costly special machines.

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RECORD BREAKERS

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HIGH-SPEED POWER BLADE

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Madison-Kipp Corp., Madison, Wisc.

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Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
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Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.

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Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
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Jones & Lamson Mch. Co., Springfield, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
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South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
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Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Union Twist Drill Co., Athol, Mass.
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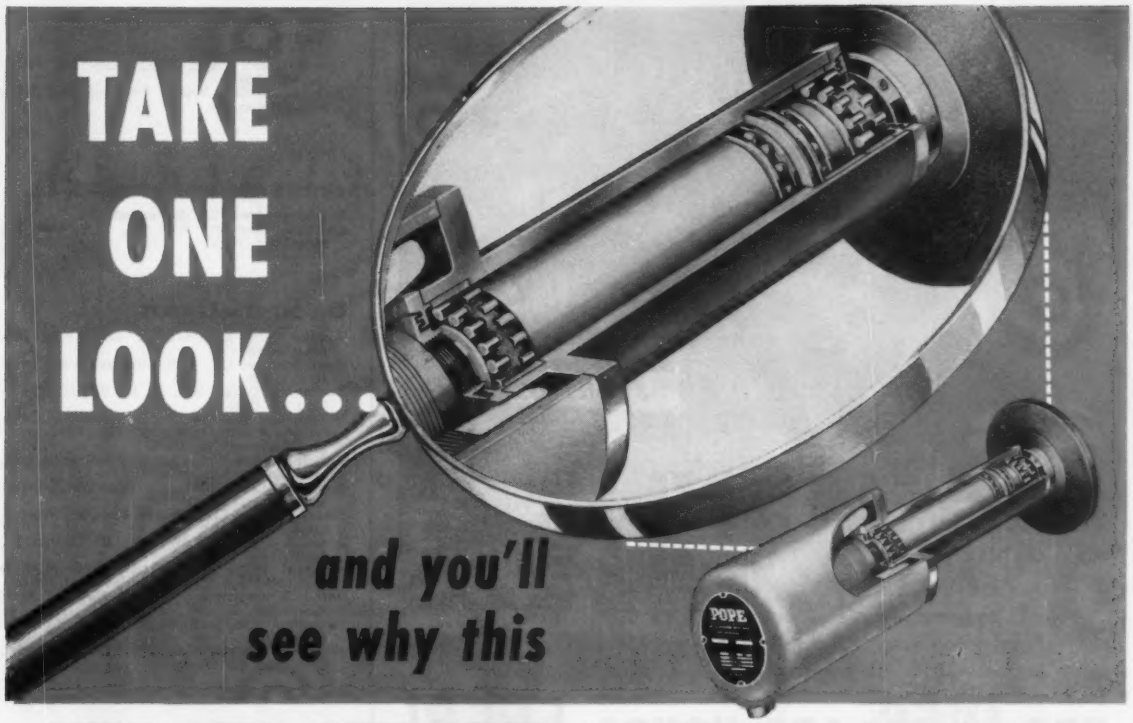

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National Acme Co., (Single and Multiple Spindle) 170 E. 131st St., Cleveland, Ohio.
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Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
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(*Continued on page* 310)

For more information on products advertised, use Inquiry Card, page 239

AIR engineering at work
REPORT No. 4400.05

Running Ten Nuts at a Crack...

SAVES $12,000 *a year!*

This large auto manufacturer formerly used two ¼ ton presses to position a differential carrier in the rear axle housing. Then the ten ⅜" nuts were run individually. Only experienced operators could control torque so that it met specifications. Naturally the engineers wanted to eliminate the press operation and improve torque control.

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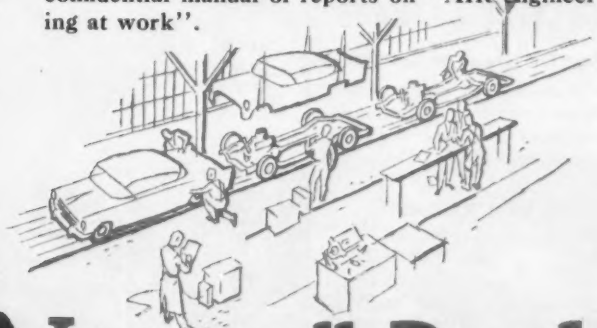
Ingersoll-Rand Multiple Nut Runner runs 10 nuts at once, all to exact torque.



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AIR engineering Manual

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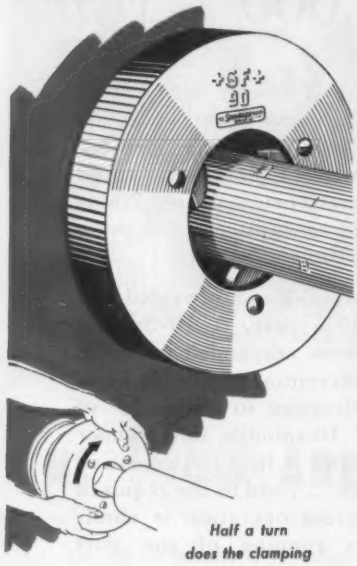

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- FAST
- SAFE
- POWERFUL
- EASY TO OPERATE

The Best for Turning on Centers

+GF+ Work Drivers drive smooth or rough bars and forgings located on centers. Jaws are easily reversed to accommodate direction of spindle rotation.

NOTE WIDE RANGES!

Type 36 ..... ¼" to 1 7/16"
Type 60 ..... 5/16" to 2 3/8"
Type 90 ..... ½" to 3 9/16"
Type 140 ..... 1 1/16" to 5½"
Type 200..... 4 15/16" to 8 1/16"

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Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
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Taft-Peirce Mfg. Co., Woonsocket, R. I.
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CHUCKS, Power Operated

Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

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Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
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Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

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Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
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Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

CLUTCHES

Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

COLLARS, Safety

Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Bridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lapping).

(*Continued on page* 312)

For more information on products advertised, use Inquiry Card, page 239

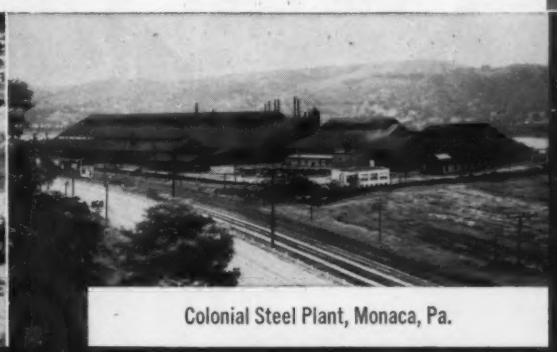
Vanadium-Alloys Steel Company

world's largest exclusive manufacturer of Tool Steels

—the capacity, the facilities, the skill and the will to serve you better!

Five manufacturing plants in the U.S. and Canada, twelve branch offices, well-stocked warehouses, a network of distributors in the major metal-working areas and individualized truck delivery provide the measure of our service ability. The First Quality of our tool steels is assured by complete specialization in manufacture and an unremitting concentration upon perfection, every working day in the year.

Vanadium-Alloys Plant, Latrobe, Pa.



Colonial Steel Plant, Monaca, Pa.

Anchor Drawn Steel Plant, Latrobe, Pa.

Hot Rolled Products from mills up to 22" diameter—Cold Drawn Products—Precision Ground Products—Plate—Sheet Circles—Forgings. Standard and Special Shapes in High Speed, Die Steel and Special Tool Steel Compositions.

Pittsburgh Tool Steel Wire Plant, Monaca, Pa.

Vanadium-Alloys Steel Canada Limited, London, Ont.

Vanadium-Alloys Steel Company

Latrobe, Pennsylvania

Subsidiaries: Colonial Steel Co. • Anchor Drawn Steel Co. • Pittsburgh Tool Steel Wire Co. • Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni

FIRST QUALITY TOOL STEELS

...more than meets the eye!
There's only one way for you to find out just how good Chicago-Latrobe Drills really are. That way is to try them. Try them and watch your production go up. The finer steels, the engineering skills, the extra experience in the use of carbides . . . all the extras that go into these fine tools show up finally in what our customers call "extra cutting mileage." Ask your distributor for
CHICAGO-LATROBE
High Speed and Carbide-Tipped DRILLS
Extra service too!
Your Chicago-Latrobe Distributor specializes in "on-time" delivery. And—he is a drilling and reaming expert who offers free counselling service on your tough problems. Call him in soon.
DOUBLE CIRCLE TOOLS
Chicago-Latrobe
417 WEST ONTARIO STREET CHICAGO 10
• DRILLS • COUNTERSINKS • CARBIDE TOOLS
• REAMERS • COUNTERBORES • SPECIAL TOOLS

Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

COMPOUNDS, Resin and Molding

General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., Springfield, Vt.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Lees-Bradner Co., Cleveland, Ohio
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

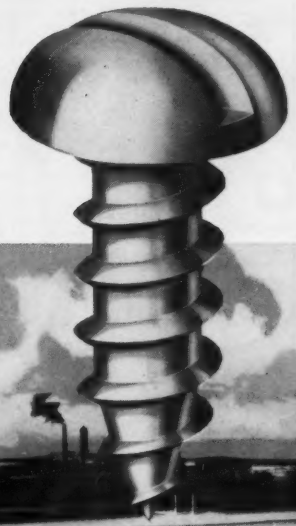
COOLANT SEPARATORS

See Separators, Oil or Coolant

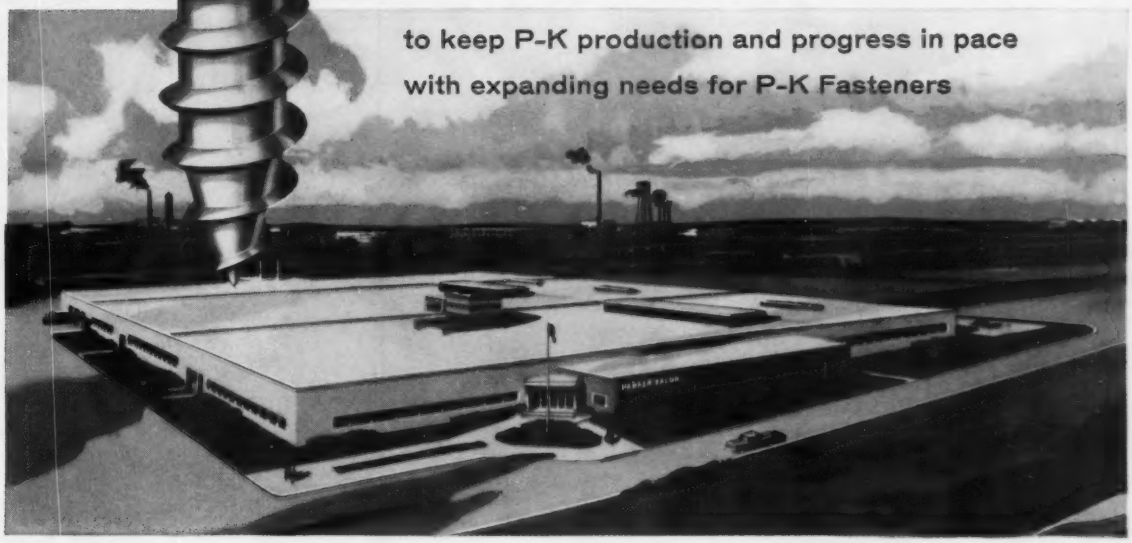
COUNTERBORES

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.

(*Continued on page* 314)



a new plant for PARKER-KALON



In a few weeks, Parker-Kalon will move to its new plant in Clifton, New Jersey (about 10 miles from New York City). This modern building, containing 267,000 square feet on one floor, is one of the largest plants devoted exclusively to the manufacture of fasteners.

It is planned for the highest efficiency and economy in all operations,with production keyed to the steadily increasing demand for P-K Fasteners throughout industry. Advanced facilities for engineering and research will accelerate P-K progress in development of new and improved fasteners.

Now, more than ever, you can be sure . . . "If it's P-K . . . it's OK!"

PARKER-KALON DIVISION
General American Transportation Corporation
Clifton, New Jersey.

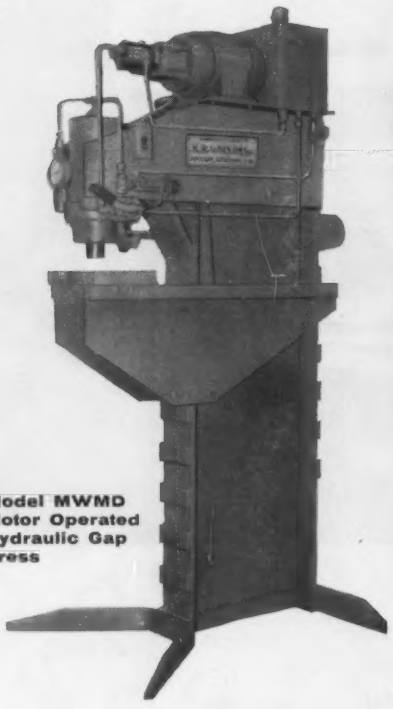
PARKER-KALON

SELF-TAPPING SCREWS – STAPS – SOCKET SCREWS – SCREWNAILS – MASONRY NAILS – WING NUTS – THUMB SCREWS

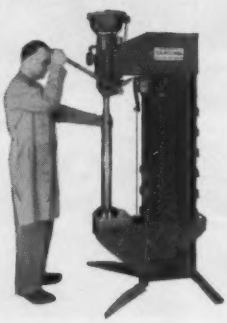
Sold through leading Industrial Distributors

NOTICE!

A REVOLUTIONARY NEW CONCEPT USED IN THE DESIGN OF THESE PRESSES. ALL OTHER FIXED BED MECHANICAL PRESSES NOW OBSOLETE!



Model MWMD Motor Operated Hydraulic Gap Press



Model MWAO Hand-Air-Oil Operated Hydraulic Gap Press

*U. S. Patents Pending and Applied for.

K. R. WILSON'S NEW ADJUSTABLE BED HYDRAULIC GAP PRESSES

We mean it. The amazing new K. R. Wilson Adjustable Gap Presses have set a new standard in versatility of operation and money saving efficiency. Here's the story.

• **COMPLETE VERSATILITY.** Handles bending, straightening, pressing and forming jobs in either maintenance or production. Fastest set-ups possible.

• **PRESS ADJUSTS TO THE WORK ON ALL JOBS.** Easy, hand-operated geared winch moves bed from 4" to 30" daylight (with ram up) at 6" increments.

• **EXCLUSIVE K. R. WILSON TILT-LOCK* SYSTEM** holds bed securely in each position. No extra adjustments needed.

• **FAST ACTION – NO LOST MOTION OR LABOR.** Ram lowers to work with cylinder preloaded ready to app., pressure immediately.

• **15 AND 25 TON CAPACITIES** available in hand-air-oil or power-driven models. Choose from 8 standard models or have K. R. Wilson's engineers modify to your particular requirements.

• **AND LOW IN COST!** These fully hydraulic presses, with adjustable bed, cost no more than ordinary fixed bed mechanical presses.

These are the facts, now get the details on K. R. Wilson's amazing Adjustable Bed Gap Presses. WRITE FOR BULLETIN No. 79 TODAY!

K. R. WILSON, Inc.
HYDRAULICS DIVISION
202 MILL ST. ARCADE, NEW YORK, U.S.A.

Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

COUNTERSHAFTS

Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Jarvis Corp., Middletown, Conn.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13 Mich.
Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution

Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S., Co., Athol, Mass.

COUNTING DEVICES

Starrett, The L. S., Co., Athol, Mass.

COUPLINGS, Flexible

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.

COUPLINGS, Shaft

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Sier-Bath & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

CUTTER GRINDERS

See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

(*Continued on page* 318)

For more information on products advertised, use Inquiry Card, page 239

New Improved

REED Thread Rolling Attachment

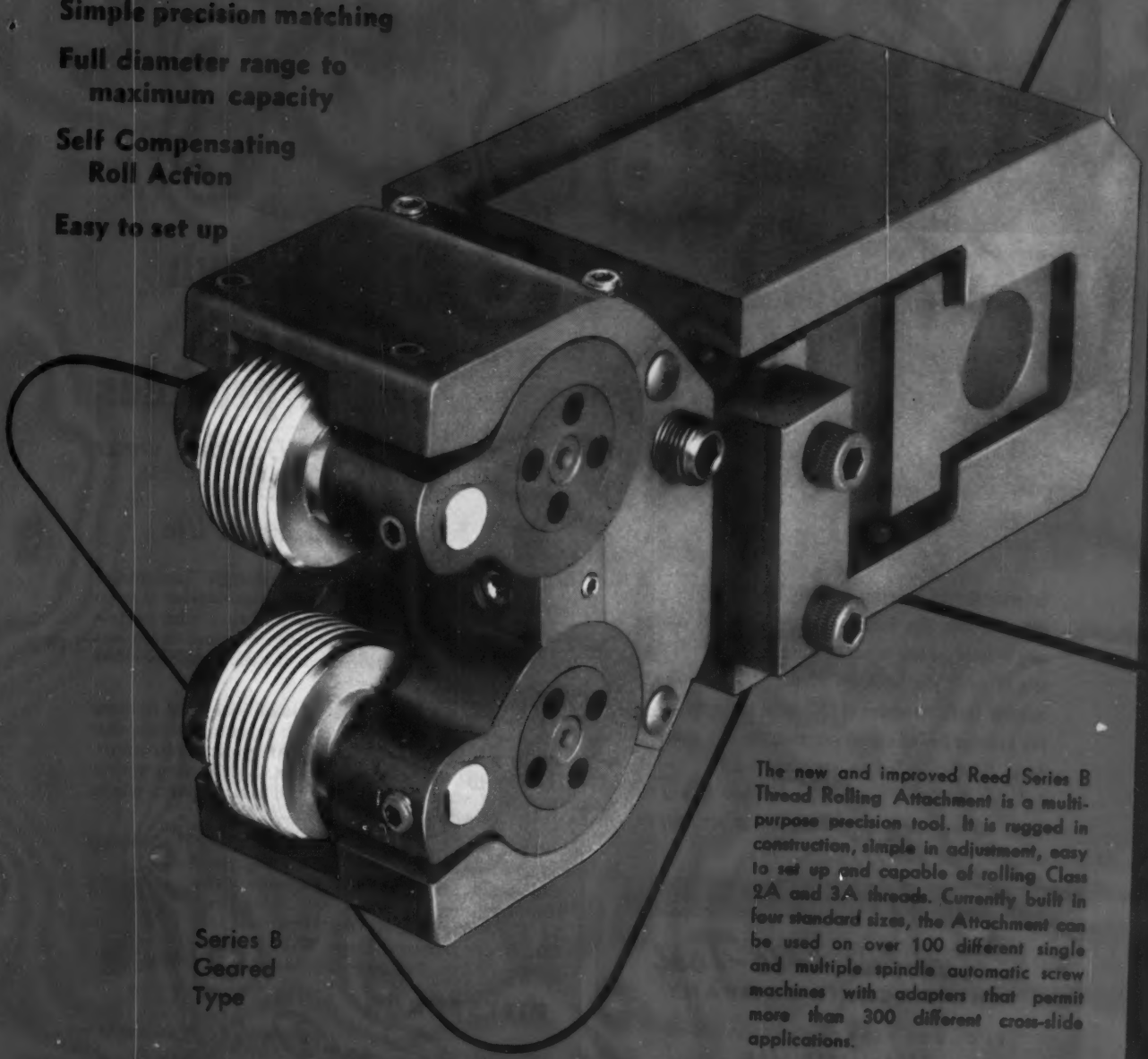
For Automatic Screw Machines

Simple precision matching

Full diameter range to maximum capacity

Self Compensating Roll Action

Easy to set up



Series B
Geared
Type

The new and improved Reed Series B Thread Rolling Attachment is a multi-purpose precision tool. It is rugged in construction, simple in adjustment, easy to set up and capable of rolling Class 2A and 3A threads. Currently built in four standard sizes, the Attachment can be used on over 100 different single and multiple spindle automatic screw machines with adapters that permit more than 300 different cross-slide applications.

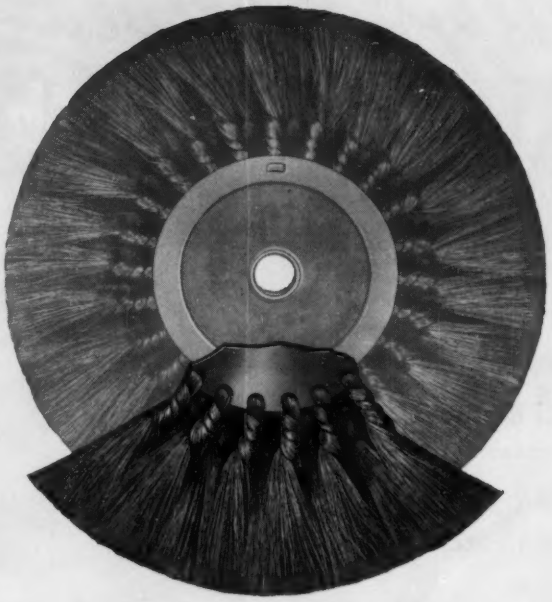
Write for Attachment Bulletin B-1

REED ROLLED THREAD DIE CO., Worcester, Mass., U. S. A.

Columbus Die-Tool

Get production off to a profitable start! Use Columbus Die-Tool engineered tools. Jigs, Fixtures, and Special Machinery individually designed and built to produce your product alone . . . at a rate to match your production schedule. That's production economy! That's the wisdom of CDT special machinery! That's how Columbus Die-Tool can put your production on a profitable basis. Columbus Die-Tool are specialists in building special tools, jigs, fixtures and machinery . . . have been for over 46 years. Talk over your special problems with us. Absolutely no obligation. Write today.

Columbus Die-Tool
AND MACHINE COMPANY
P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906
Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS



How Pittsburgh knotted brush construction provides

• *Better Balance* • *Uniform wear*
• *Better cleaning*
• *Longer equipment life*

Because of their construction, Pittsburgh "Lightning" knotted sections have *exactly the same number of wires in every knot.* As a result, you get a brush with perfect balance—one that will wear uniformly and cause less bearing-destroying vibration in the machine that drives it!

What's more, the special type of wire used in these knots is the fastest cutting, with the longest life, that can be produced. Built for the toughest applications, "Lightning" brushes are perfect for cleaning welds, removing scale or rubber, or cleaning parts where penetration brushing is needed.

This is just one example of superior Pittsburgh construction, engineered for both general and specific applications. For details of the complete line, write for free Catalog No. 54-W. Address: PITTSBURGH PLATE GLASS CO., *Brush Division,* Dept. W-11, 3221 Frederick Ave., Baltimore 29, Maryland.

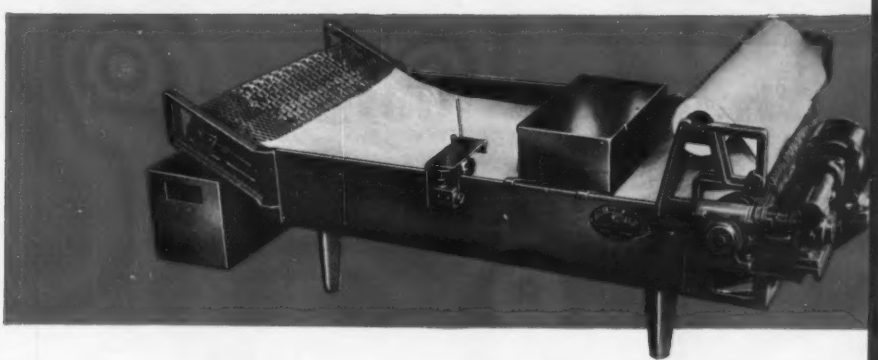
PITTSBURGH
Power Driver
BRUSHES
BRUSHES • PAINTS • GLASS • CHEMICALS • PLASTICS • FIBER GLASS
PITTSBURGH PLATE GLASS COMPANY
IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

For more information on products advertised, use Inquiry Card, page 239

Delpark FILTERS...

Major Choice

OF GRINDING MACHINE MANUFACTURERS AT THE MACHINE TOOL SHOW*



Principal Manufacturers Exhibiting at the Machine Tool Show Chose Delpark Filters for Their Equipment

Delpark

INDUSTRIAL FILTRATION

Backed by more than 40 years experience in industrial filtration

Did you note the number of Delpark Filters shown with grinding machines at the Machine Tool Show?

The reason is obvious. When engineers of grinding machines specify Delpark Filters, they assure their equipment of the finest in coolant filtration permitting the greatest machine accuracy and efficiency.

When builders know and specify Delpark Filters . . . you too can assure yourself . . . it's the finest.

INDUSTRIAL FILTRATION COMPANY, 15 INDUSTRIAL AVENUE, LEBANON, INDIANA

Change cutting tools in 5 seconds!

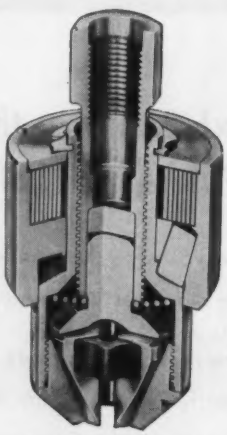
The Jacobs Impact Keyless Chuck designed especially for the aircraft industry makes fast tool changing possible, *and that's not all*—

This chuck has more gripping power than any ¼" chuck in the world.

This chuck *holds* tools in its tremendous grip — there's no slippage, no shank scoring, cutting tools last longer and replacement costs are drastically reduced.

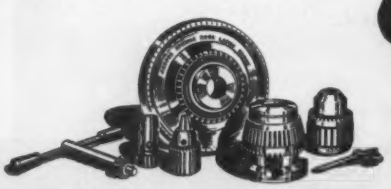
This chuck has no key — to use or to lose.

The performance of the Jacobs Impact Keyless Chuck is another reason why you can continue to look to Jacobs for unquestioned, unequalled and uncompromising quality in the manufacture of hard holding, long lasting precision chucks.



Jacobs Manufacturing Co.
West Hartford 10, Conn.

JACOBS AND YOUR LOCAL DISTRIBUTOR
are ready to deliver the chucks you need and the service you deserve.
first in chucks . . . first in service



Jacobs
CHUCKS
If it's a Jacobs–it holds

CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. (Thread).
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burrs Rotary

CUTTING COMPOUNDS

See Compounds, Cutting, grinding, Etc.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

(*Continued on page* 320)

Introducing ANOTHER MERCURY PRODUCTION METHOD . . .

Combination

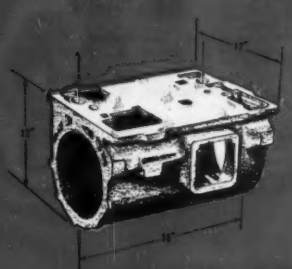
GRINDING
DRILLING
BORING

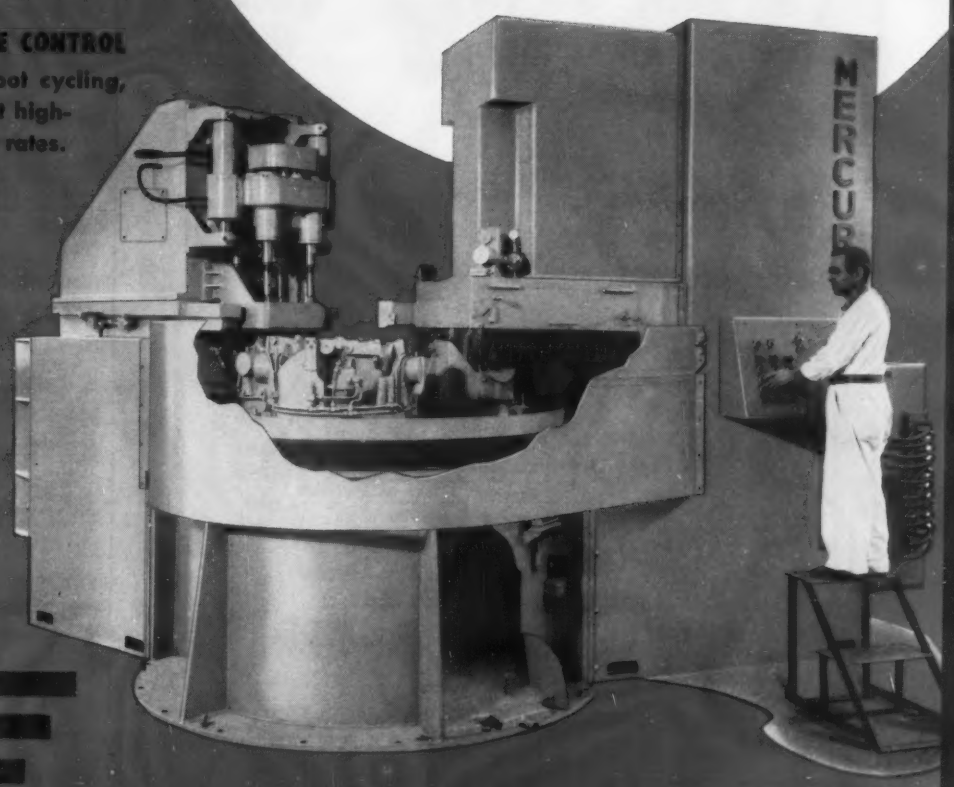
✓ **GRINDING**
produces unexcelled flatness and finish directly from "as cast" condition.

✓ **DRILLING AND BORING**
in the same chuck, coordinates tooling holes perfectly with first surface and target locators.

✓ **AUTOMATIC SIZE CONTROL**
together with robot cycling, assures quality at high-speed production rates.

50 large transmission cases per hour, finish ground, drilled and bored.





EMF
A SYMBOL OF FINE CRAFTSMANSHIP SINCE 1933

MERCURY — *Designers and Builders of Special Grinding Machines*

MERCURY
ENGINEERING CORPORATION

Milwaukee 2, Wisconsin

Your Inquiry Is Invited

NEW
WILLIAMS
LOCKING
ADJUSTABLE
WRENCH
THE ONLY REAL ADJUSTABLE
WRENCH IMPROVEMENT
IN OVER 40 YEARS!
PUSH DOWN TO UNLOCK
AVAILABLE
AT NO EXTRA
COST
PUSH UP TO LOCK
WITH FEATURES
YOU HAVE ALWAYS WANTED IN
AN ADJUSTABLE WRENCH
• No Obstructions
• Structurally Sound
• Positive Lock
• Rapid Adjustment
• One Hand Operation
• No Fumbling
• Drop-Forged from Selected Alloy Steel and Chrome Plated
AVAILABLE IN FOUR MOST POPULAR SIZES
No. Size Capacity List Price
6L 6" 3/4 $2.06
8L 8" 15/16 $2.45
10L 10" 1 1/8 $3.10
12L 12" 1 5/16 $4.50
WILLIAMS
INDUSTRIAL TOOLS
"The Broadest Line of Its Kind"
WRITE for descriptive folder No. A-465. Also ask for Catalog 302 showing the latest patterns and sizes in Williams broad line of industrial tools.
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Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
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Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Landis Machine Co., Waynesboro, Pa., (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel

Campbell Machine Div., American Chain & Cable, Bridgeport, Conn.
Hamilton Div., The Lodge & Shipley Co., Hamilton 1, Ohio.
Wallace Tube Co., 1304-08 Diversey Pkwy., Chicago, Ill.
Master Chemical Corp., 13 Huron St., Toledo 1, Ohio.

CUTTING-OFF MACHINES, Cold Saw

See Sewing Machines, Circular

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Grob, Inc., Grafton, Wis.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo

CUTTING-OFF WHEELS, Abrasive

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

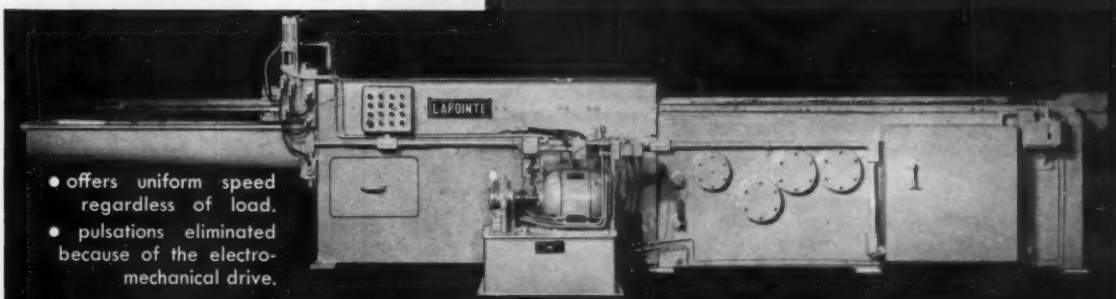
Baker Bros., Inc., Sta. F, Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

(*Continued on page* 322)

LAPOINTE

BROACHING SPROCKETS and GEARS

CIRCULAR SAWS



- offers uniform speed regardless of load.
- pulsations eliminated because of the electro-mechanical drive.

built for amazingly smooth broaching operation!

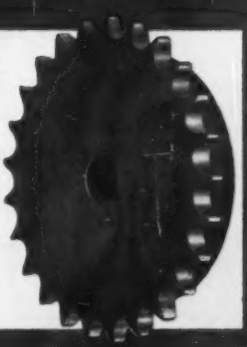
this new LAPOINTE ELECTRIC DRIVE offers speeds up to BROACHING MACHINE 300 feet per minute!

CHANGE GEAR FIXTURES
are available for broaching **SPROCKETS**
in a series of ranges from
4″ to 20″ diameter
18 to 112 tooth sprockets
3/8″ to 5/8″ pitch

Note: Fixtures and tooling can be provided for larger sprockets and a greater number of teeth.

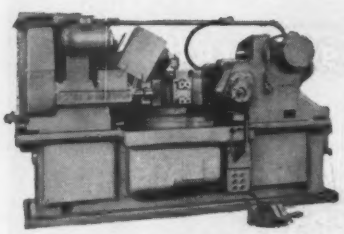
Send us your inquiries!

this 25 tooth sprocket
is an example of the work that this machine is particularly designed for. Broaching two at a time at 150 feet-per-minute, and holding a tolerance within .002″, the net production is
one sprocket per minute



LAPOINTE MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS • U. S. A.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



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CHUCKING
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When any of the various functions for which this machine is designed are performed on it, no further machining is required. The job is finished.

The basic "1-2-3" method—exclusive with Goss & DeLeeuw—provides for gripping work in the chuck and machining all ends either simultaneously or in sequence. By eliminating several handlings and set-ups, the "1-2-3" method produces finished pieces at a fraction of the time and cost ordinarily required.

Send samples of your work for time estimates. Ask for illustrated literature containing detailed information.

GOSS & DeLEEUW

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

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Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic
Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co. Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DEALERS, Machinery
Falk Machinery Co., 18 Ward St., Rochester, N. Y.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

DEMAGNETIZERS
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Pierce Mfg. Co., Woonsocket, R. I.
Walker, O. S. Inc., Worcester, Mass.

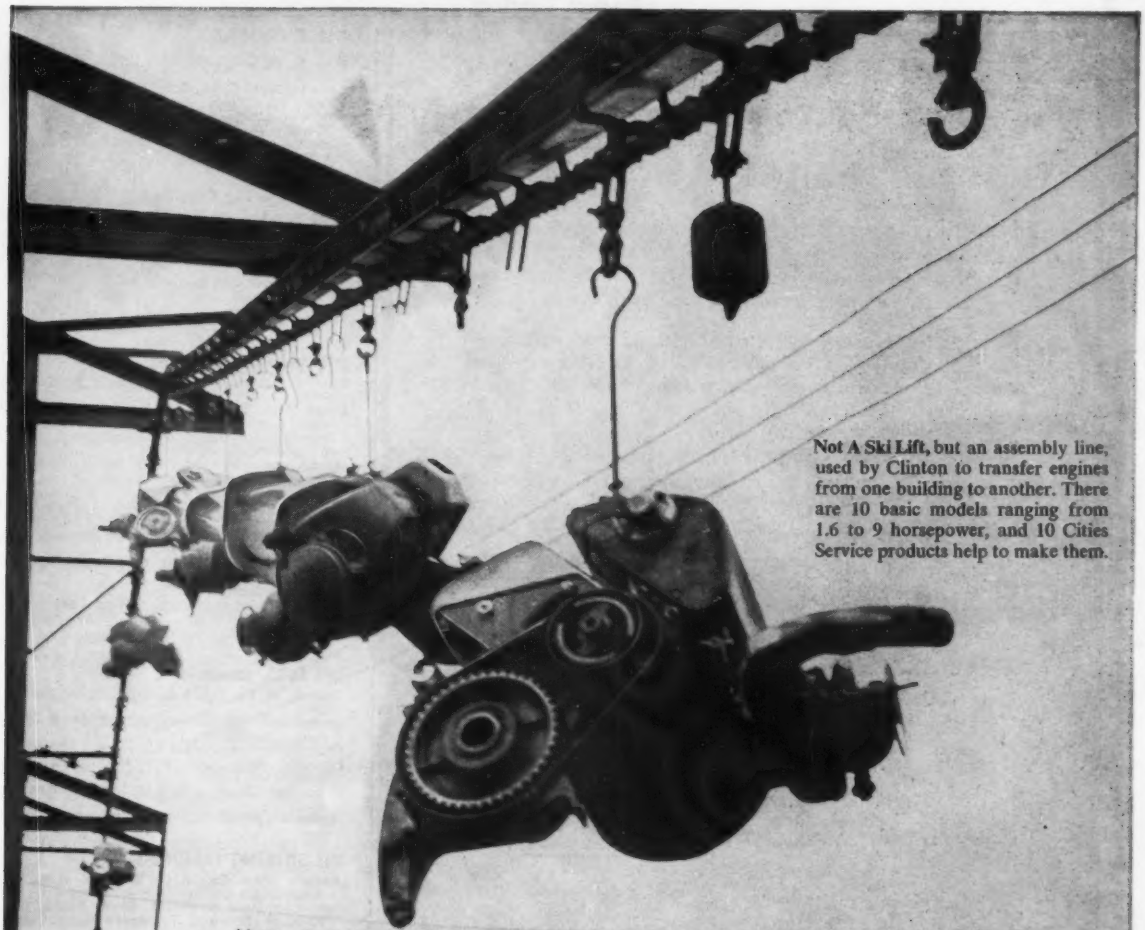
DESIGNERS, Machine and Tool
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Specialty Mchry. Co., 287 Homestead St., Hartford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIAMONDS AND DIAMOND TOOLS
Christensen Diamond Prod., 1937 S. Second West, Salt Lake City, Utah
Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING
See Castings, Die

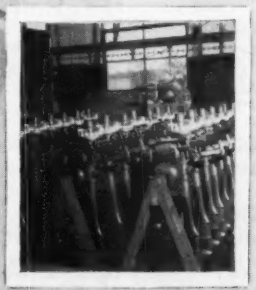
DIE-CASTING MACHINES
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engineering Corp., Kenmore Station Buffalo, N. Y.

(*Continued on page* 324)



Not A Ski Lift, but an assembly line, used by Clinton to transfer engines from one building to another. There are 10 basic models ranging from 1.6 to 9 horsepower, and 10 Cities Service products help to make them.

"3,000,000 ENGINES IN EIGHT YEARS... CITIES SERVICE PLAYED MAJOR ROLE."



Outboard Motors are one of the chief products of Clinton Machine Company. Others include chainsaws and many types of gasolene engines for small power requirements.

Phenomenal is the word for Clinton Machine Company, Clinton, Michigan. Formed in 1946, it has expanded so rapidly that today it claims second place among U. S. producers of air-cooled gasolene engines and has already marketed 3,000,000 of these and other engines.

Were there lubrication problems? Of course. "But," says President Don Thomas, "I am happy to say they have continually been taken care of by Cities Service from the very beginning. In these formative years, Cities Service engineers came to our plants and recommended the proper lubricants for both our production machinery and the products we make. Thus, for the past eight years, we've used Cities Service Chillo Cutting Oils, Trojan Greases and Pacemaker Oils with complete satisfaction. We don't hesitate to say that the cooperation and outstanding service offered by Cities Service plus the quality of its products has played a major role in helping us build the Clinton Machine Company."

Time and again manufacturers like Clinton report unusual results using Cities Service Lubricants. Find out why. *You* may profit, too. Talk with your local Cities Service Lubrication Engineer or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

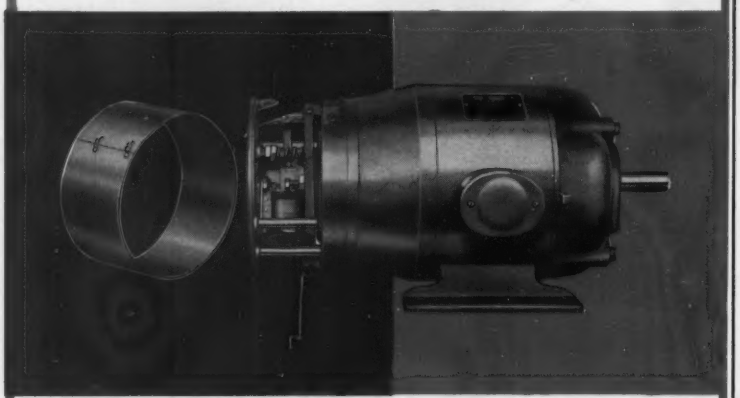
to MACHINE DESIGNERS, Howell suggests

What to look for in Brake Motors

Long-life braking action Durability in the brake means less maintenance on your machines. Howell's super tough friction disc is spline-mounted for extra strength. Push rod and rocker arm slots are heat treated to file hardness (60 Rockwell C).

Fail-safe operation protects machine and products in emergencies. In case of power failure, the Howell brake sets automatically. Brake is also equipped with hand-operated lever to permit manual braking.

Accessibility and Compactness The Howell brake has a wrap-around cover that removes in seconds for quick easy brake adjustment. Because cover removal requires no end clearance, the Howell brake takes up minimum space.



NEMA-Standard motors give machine builders and users complete motor interchangeability, help them reduce inventories and simplify purchasing. Howell brake motors give you this valuable feature—with the new re-rated motors included!

Fully-protected bearings insure longer motor life. Dirt can't enter Howell's double-shielded bearings either from inside or outside the motor, because they are sealed in the end-plate cavities by dust-tight inner caps.

Copper-clad rotors mean better heat conductivity, stability at high temperatures and, as opposed to die-cast rotors, greater design flexibility to meet your particular motor requirements. All Howell motors have them.

Howell brakes **are torque rated for up to 50 lb. ft. for continuous duty; up to 75 lb. ft. for intermittent duty.**

Shown left are two of many possible mechanical variations: a vertical C-face mounting and a unit incorporating the super-compact Howell disc motor.

WRITE FOR BULLETIN BR-2

HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Precision-built motors for industry since 1915

HOWELL Red Band MOTORS

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Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennamental Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

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Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mach. Co., Oakley, Cincinnati 9, Ohio.
Grob, Inc., Grafton, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.

DIE SETS, Standard

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 225 N. 18th St., Ampere, N. J.
Wales-Strippet Corp., North Tonawanda, N. Y.

DIE-SINKING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Groton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIE-SINKING PRESSES

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Kearney & Trecker Corp., Milwaukee, Wis.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

DIE STOCKS

See Stocks, Die

DIES, Sheet Metal, Etc.

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept. General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mach Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krupp Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Winzeler Mfg. & Tool Co., 1712 W. Arcade Pl., Chicago 12, Ill.

(*Continued on page 326*)

Talking About Die Sets

WITH

PHIL MARSILIUS

Vice-President
The Producto Machine Co.

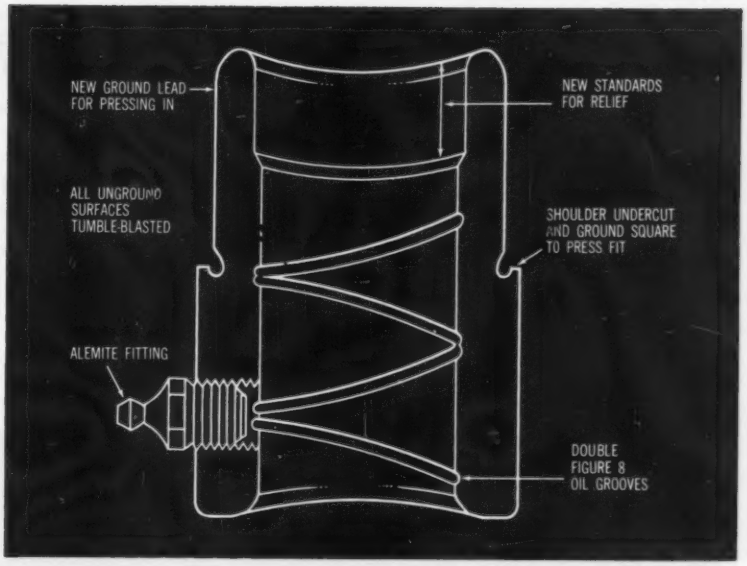
Lubricate for Longer Life—Faulty or insufficient lubrication of guide pins and bushings can result in a rapid reduction in the accuracy of die operation. Since the relationship between wear and friction is a direct ratio, proper lubrication greatly reduces wear and increases the useful life of pins and bushings. There are many fields of thought as to the type of lubricant best suited to die set operations at different speeds and varied accuracy requirements. The type used depends on the experience of the press-room foreman. The method of application also varies widely to suit individual needs.

Standard lubrication methods involve a simple oil groove in the bushing. Here are a few inexpensive systems using the guide pin bushing as a source of lubrication: 1. Relief in the top of bushing is loaded with oil or grease; 2. Oil caps that feed oil into either a circular or Figure 8 groove in bushing through a hole in bushing wall; 3. An oil or grease fitting through which lubricant is forced manually as the need arises; 4. An oil reservoir cup that fits snugly over pin and from which oil is dipped onto bushing with each stroke of the press and is drawn up to completely coat bearing surface of pin for next downward stroke; 5. A steel oil-retaining ring containing a felt washer that fits over pin and slides up and down by spring-loading action or is attached to bushing.

Guide pins also have been made with oil grooves around the circumference or with splines or slots along the length, fed from inside through small connecting holes. Here, of course, bearing surface is somewhat reduced and pins tend to pick up dirt or chips.

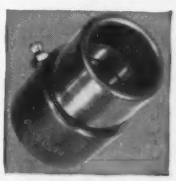
Another method minimizes the amount of lubrication required. Bushings are made of bronze or other "soft" materials which hold lubricant in their surface while at the same time reducing friction normally encountered with like metal contact.

Whatever method you choose, proper lubrication will add life to your die sets and help maintain die accuracy.


NEW GROUND LEAD FOR PRESSING IN
NEW STANDARDS FOR RELIEF
ALL UNGROUND SURFACES TUMBLE-BLASTED
SHOULDER UNDERCUT AND GROUND SQUARE TO PRESS FIT
ALEMITE FITTING
DOUBLE FIGURE 8 OIL GROOVES

Cutaway drawing of new Producto bushing

NEW PRODUCTO BUSHINGS IMPROVE DIE SET ACCURACY, APPEARANCE AT NO EXTRA COST



Producto has engineered five important new design features into its master bushings*—the heart of the die set—which provide greatly improved accuracy and appearance *at no additional cost to users:*

1. NEW STANDARDS FOR RELIEF give greater bearing surfaces, improve accuracy. 2. GROUND SHOULDERS seat bushings square to punch holder, guaranteeing perfect alignment. 3. NEW GROUND LEAD ON PRESS FIT starts bushing into punch holder easily. 4. DOUBLE FIGURE 8 OIL GROOVES fed by grease fitting provide a constant source of lubrication to pin and bushing. (Optional spring-loaded grease cups are available.) 5. TUMBLE-BLASTING OF ALL UNGROUND SURFACES polishes surfaces in areas normally not finished after hardening.

These innovations are typical of the steps being taken to keep Producto's die set quality abreast of its service.

If you would like to receive *Die Set Digest,* our new, fact-filled quarterly, just drop us a note. And remember, for precision die sets fast, call your nearest Producto branch.

*"Popular size" master die sets already have these new bushings. They will soon be available on all sizes.

THE PRODUCTO MACHINE COMPANY
985 Housatonic Avenue, Bridgeport 1, Connecticut
Telephone FOrest 7-8675

For prompt die set service, 'phone these PRODUCTO assembly warehouses:

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Cleveland	SU 1-6158	Los Angeles	TR 9826	St. Louis	FR 3370
Dayton	MU 1651	New York	WO 4-7484	or check the Yellow Pages in	

any stamping center in the United States or Canada for distributors stocking PRODUCTO.

Produce More With

PRODUCTO

Precision Die Sets

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Card, S. W., Mfg., Mansfield, Mass.
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Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

DIES, Thread Rolling

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

DISCS, Abrasives

Besley-Welles Corp. (Abrasive Div.) 20 N. Wacker Drive, Chicago 6, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

DISINTEGRATORS

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DIVIDING HEADS

See Indexing and Spacing Equipment

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Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRESSERS, Grinding Wheel

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., Youngstown, Ohio.
Meyers, W. F. Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.

DRIFTS, DRILL

Armstrong, Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth, Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Jarvis Corp., Middletown, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakewood Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

(*Continued on page* 328)

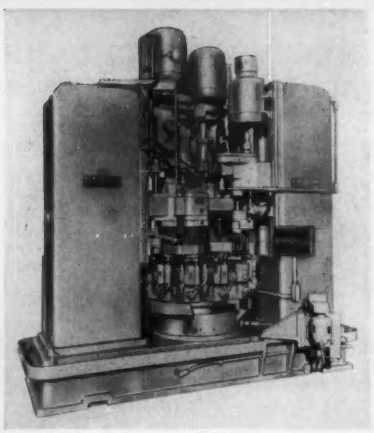
MILLHOLLAND

12-Station Vertical Indexing Machine

34 Spindles!

93 Pieces per Hour!

Here is Millholland versatility in action!



Lead Screw Tapper with reversing motor drives a 6-spindle tapping head. All machine elements are electrically synchronized, with push-button control for "cycle start," automatic single cycle, set-up and emergency stop. Chip disposal is simplified with wiper blades rotating within a ring on the index table to bring chips to a removable pan.

Unique Holding Fixture

With a 31-second cycle time, this machine produces 93 pieces per hour at 80% efficiency! This chip cutting efficiency is made possible by the distinctive design of the plate type cam used in Millholland Automatic Units, plus the action of the pneumatic counterbalance.

Two No. 5 Units are mounted vertically, the first with 22 spindles, the second with 5; a No. 2 unit is mounted horizontally on a rapid travel slide, and an Automatic

Part requirements dictated location using self-centering horizontal vees with upacting clamps, actuated by a single handle operating through a small arc. Fixtures also contain register pins for all bushing plates. The 12 fixtures are mounted on an independently powered automatic index table with self-contained lubrication pump.

A complex production problem, solved efficiently with Millholland equipment and Millholland know-how.

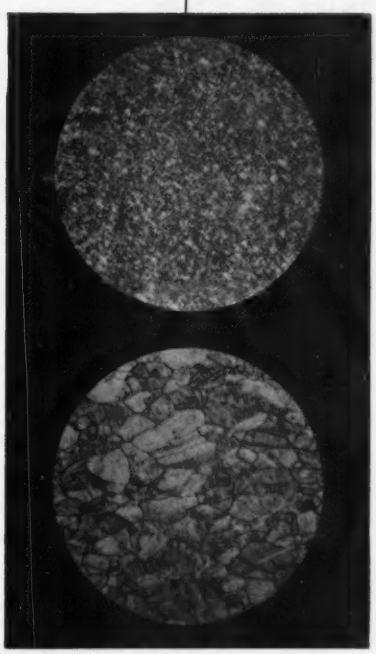
Write for Bulletin M-9 giving further details.

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd. Indianapolis 20, Indiana

DURAFLEX...

a NEW fine-grain phosphor bronze with 30% GREATER ENDURANCE LIMIT

FINE-GRAIN STRUCTURE IS THE MAIN REASON...



Micrographs (75x magnification) tell the inside story. Top, note the fine-grain structure of DURAFLEX. Compare it with the grain structure of ordinary phosphor bronze, bottom.

DURAFLEX* is a new, fine-grain phosphor bronze developed and sold only by Anaconda. Comparative fatigue tests show that the endurance limit of DURAFLEX is approximately 30% higher than for ordinary phosphor bronzes. In surface appearance surface smoothness and resistance to corrosion, it is equal to, or better than, other phosphor bronzes. Further, its formability is increased with no sacrifice in yield strength. DURAFLEX is a *premium* phosphor bronze in every way except cost; there's *no increase in price.*

If you're now using a hard-temper phosphor bronze, chances are that you can do the same forming in extra-hard temper DURAFLEX. If you're looking for longer life in the parts you form, we'll be glad to send you a free sample of DURAFLEX. Try it, test it, and you will agree that it's superior.

5576

*Trade-Mark

DURAFLEX fine-grain phosphor bronze

an ANACONDA® product

MADE BY THE AMERICAN BRASS COMPANY

Try a FREE SAMPLE of

DURAFLEX

Sheet . . . up to 0.062" thick
Wire . . . up to 3/16" diameter (approx.)

FREE SAMPLE

The American Brass Company, Waterbury 20, Connecticut
(In Canada: Anaconda American Brass Ltd., New Toronto, Ontario)

Yes, we'd like to try DURAFLEX. Please send us a free sample of
sheet in _____ temper, _____ thick,
wire in _____ temper, _____ diameter.
☐ We'd like to talk to one of your metallurgists about DURAFLEX.

NAME.....
COMPANY.....
STREET.....
CITY.....ZONE....STATE.....

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Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
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Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.
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Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

DRILLING MACHINES, Boiler

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

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Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S 7th and N. St., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Wales-Strippet Corp., North Tonawanda, N. Y.

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Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
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Consolidated Mch. Tool Corp., Rochester, N.Y.
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Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
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Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H

(*Continued on page* 330)

BURR-MASTER

For Every Gear Deburring Job

You can't afford obsolete methods when Burr-Masters can "deburr and chamfer" gears and splines up to 300 teeth per minute!

Universal machines for internal gear and spline deburring. Data in Bulletin 103-81.

Hypoid pinion deburring machines are available in single or multiple station models. Data in Bulletin 103-100.

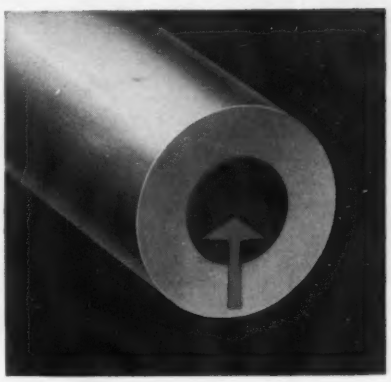
Eight Universal models, single or two station, deburr and chamfer spur or helical gears and external splines. Get complete data in Bulletin 103-60.

14230 BIRWOOD AVE. **MODERN** DETROIT 38, MICHIGAN

Industrial Engineering Co.

Crucible Steel Company of America

a hole here wastes time . . .



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Crucible Hollow Tool Steel Bars save time — and money too — whenever you need ring-shaped steel parts, or tools with a center hole. The tool steel is drilled through when you get it! You don't need to bore, drill, hole-saw, cut off or rough-face. That's why they cut your production time, increase machine capacity — and reduce scrap losses.

You can get these hollow bars in any of Crucible's famous quality tool steels, in almost any combination of OD and ID sizes. And you can get *immediate* delivery of five popular grades — KETOS oil-hardening; SANDERSON water-hardening; AIRDI 150 high carbon, high chromium; AIRKOOL air-hardening; and NU DIE V hot-work tool steels — from the Crucible warehouse near you.

Call your Crucible representative for the full story of how these steels can save time and money in your shop. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

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Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Greenfield Tap & Die Corp., Greenfield, Mass.
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Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
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Kingsbury Mch. Tool Corp., Keene, N. H.
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Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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DRILLING MACHINES, Bench

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Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
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Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

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Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S 7th and N. St., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Wales-Strippet Corp., North Tonawanda, N. Y.

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Edlund Machinery Co., Cortland, N. Y.
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Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
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Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
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Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
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Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
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(*Continued on page* 330)

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MODERN Industrial Engineering Co.

14230 BIRWOOD AVE. DETROIT 38, MICHIGAN

Crucible Steel Company of America

a hole here wastes time . . .

a hole here saves time

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You can get these hollow bars in any of Crucible's famous quality tool steels, in almost any combination of OD and ID sizes. And you can get *immediate* delivery of five popular grades — KETOS oil-hardening; SANDERSON water-hardening; AIRDI 150 high carbon, high chromium; AIRKOOL air-hardening; and NU DIE V hot-work tool steels — from the Crucible warehouse near you.

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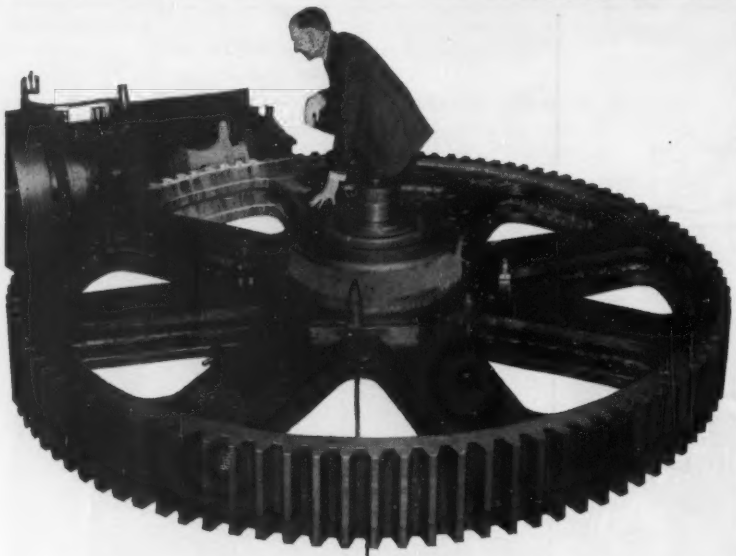
CRUCIBLE first name in special purpose steels

Crucible Steel Company of America



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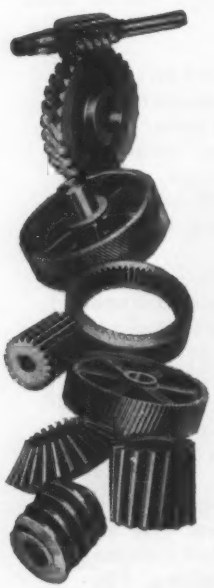

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Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

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Cross Co., 3250 Bellevue, Detroit 7, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

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Barnes, W. F. & John, Co., 201 S. Water St. Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
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Cleereman Mch. Tool Co., Green Bay, Wis.
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Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
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Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
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Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
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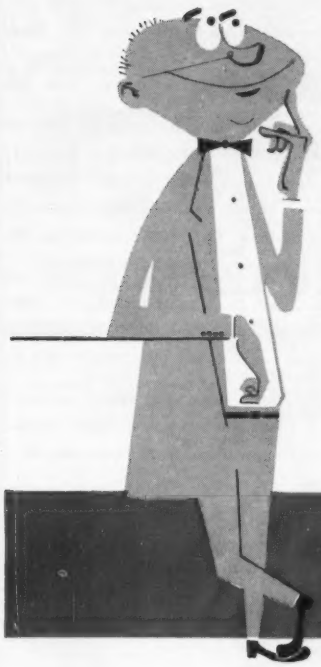
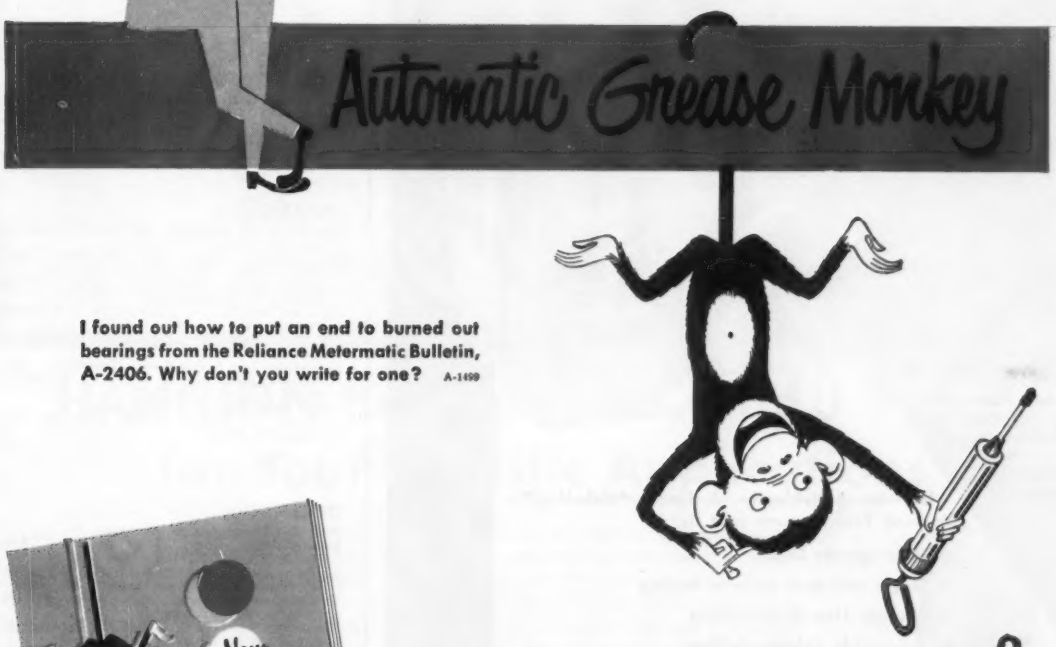
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

(*Continued on page* 332)

BEARING TROUBLES?



NO SIR! Not with new Reliance Motors and METERMATIC • • • • the



I found out how to put an end to burned out bearings from the Reliance Metermatic Bulletin, A-2406. Why don't you write for one? A-1490

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DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
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Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
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101
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Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101. Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

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Cleveland Punch & Shear Works, 3817 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS Center

The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Ace Drill Corp., Adrian, Michigan.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page* 334)

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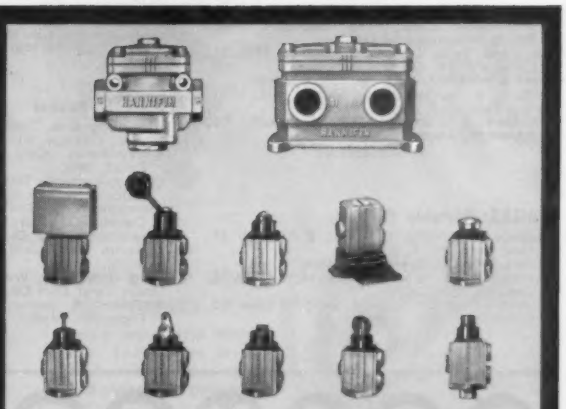

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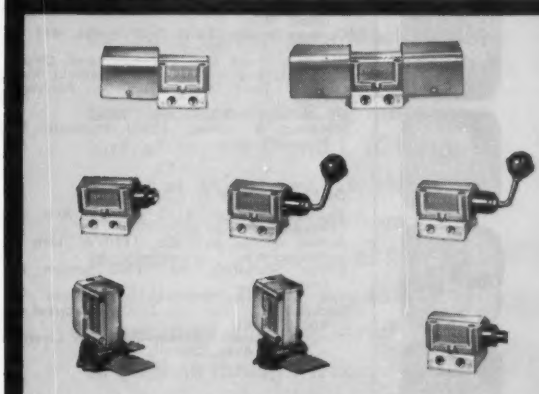

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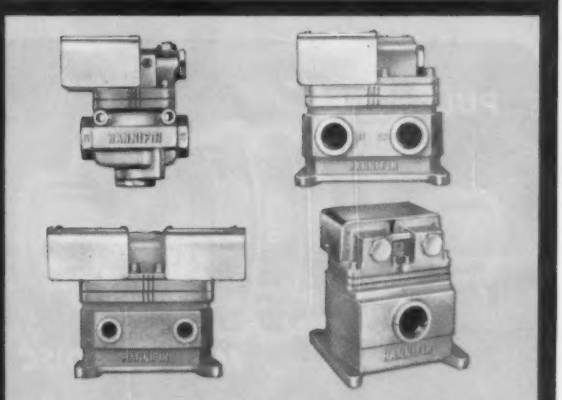

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

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Chicago Pneumatic Tool Co., 6 E. 44th St., New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLS, Rachet

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Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Subland

Ace Drill Corp., Adrian, Michigan.
Mohawk Tools, Inc., 910 E. Main St., Montpelier, Ohio.

DRILLS, Twist

Ace Drill Corp., Adrian, Michigan.
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATORS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

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EMERY WHEELS

See Grinding Wheels

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Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

ENGRAVING MACHINES

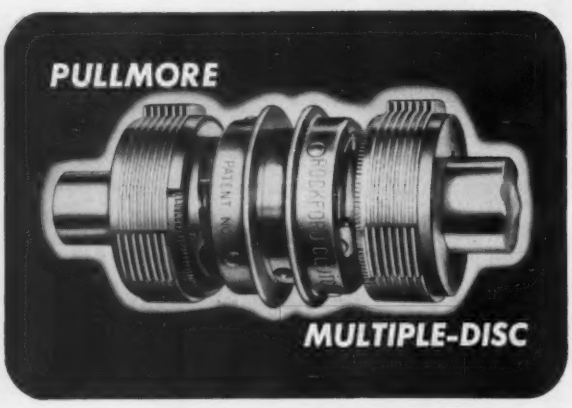
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

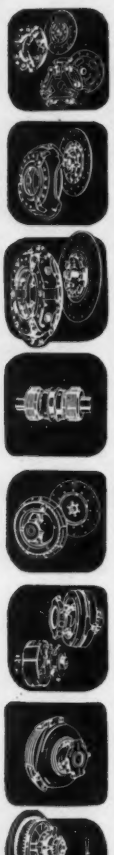
EXTRACTORS, Screw

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page* 336)

ROCKFORD





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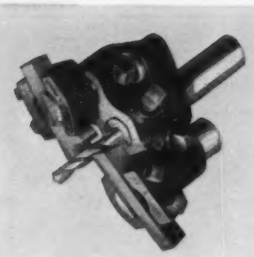

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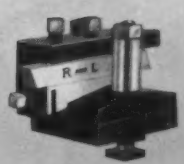

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Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

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Heller Tool Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Jarvis Corp., Middletown, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.

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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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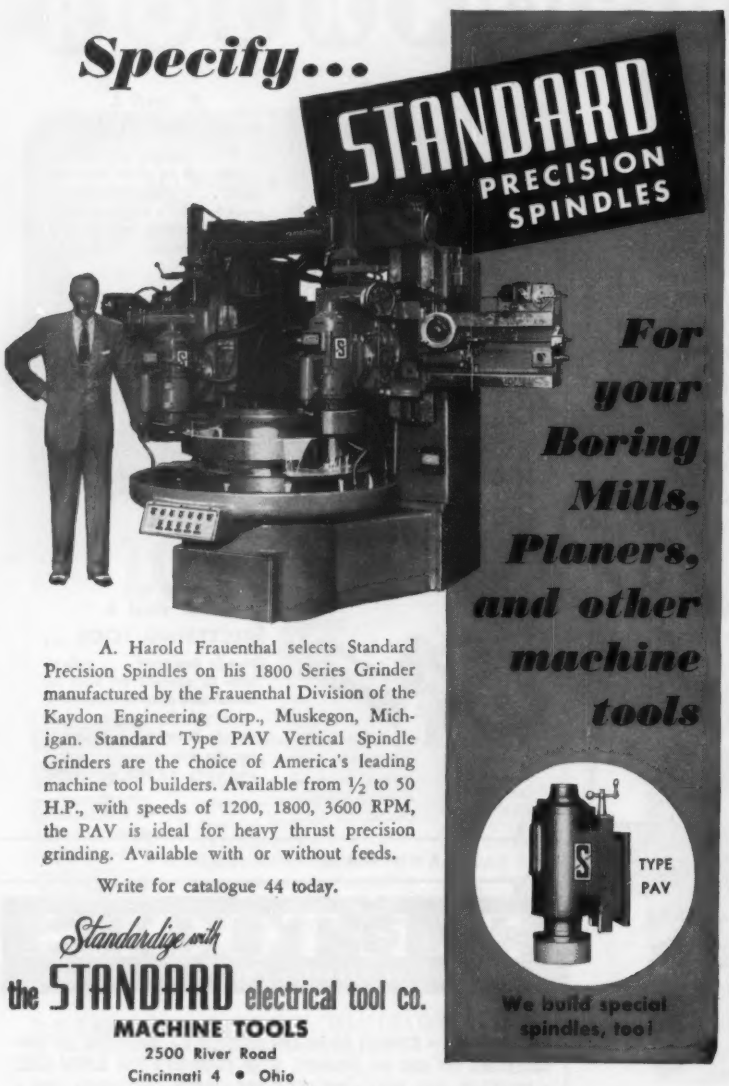
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.

(*Continued on page* 338)



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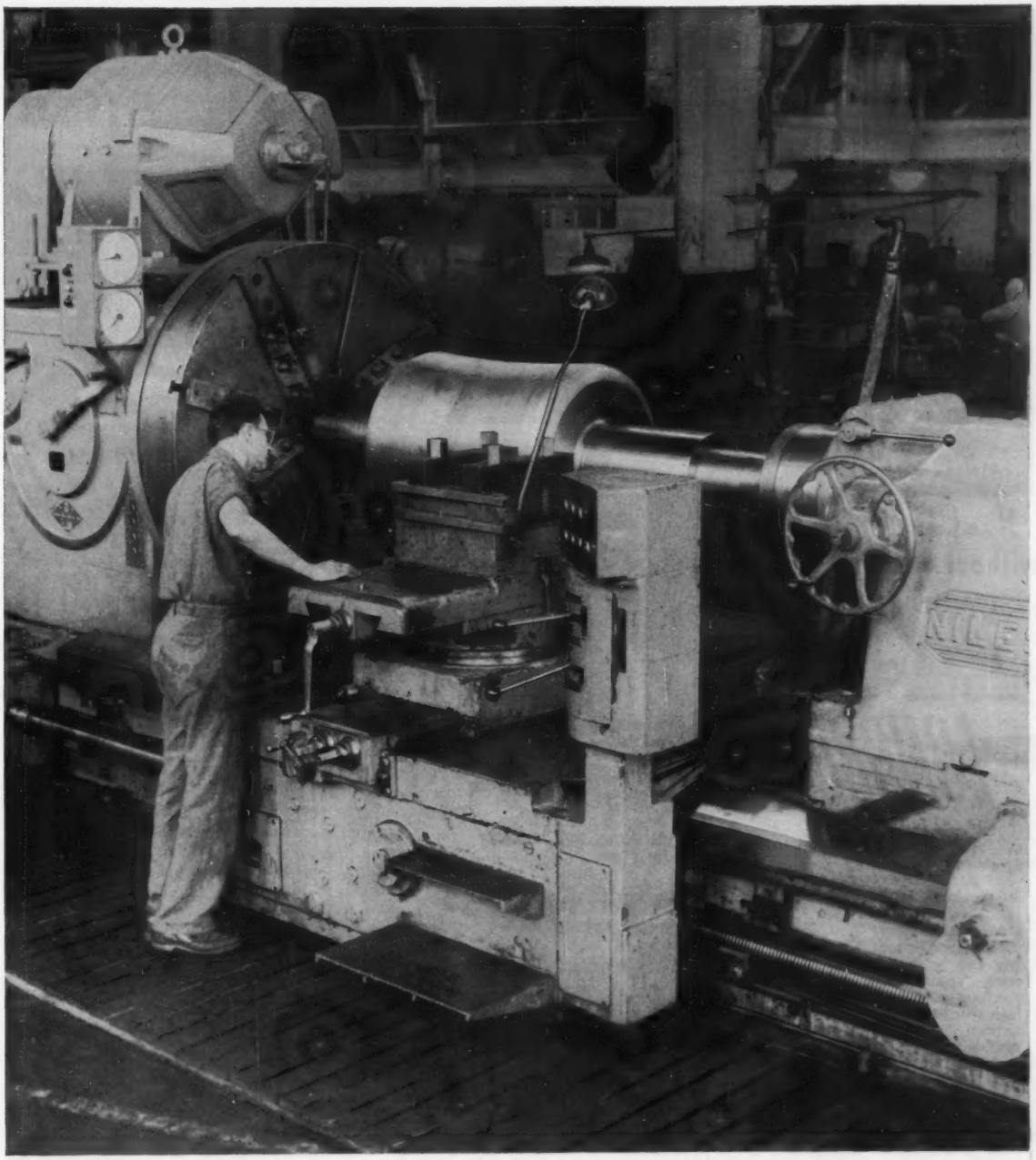

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Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
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Taft-Peirce Mfg. Co., Woonsocket, R. I.
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Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
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Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
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Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Electric

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GAGES, Height

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap

Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Elgin National Watch Co., Aurora, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GAGES, Surface

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1 Ohio
Starrett, The L. S., Co., Athol, Mass.

(*Continued on page* 340)

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Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
General Electric Co., Schenectady 5, N. Y.

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Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

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Bilgram Gear & Mch Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

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Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR CUTTING MACHINES, Worm and Worm Wheels

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Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
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Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

(*Continued on page* 342)

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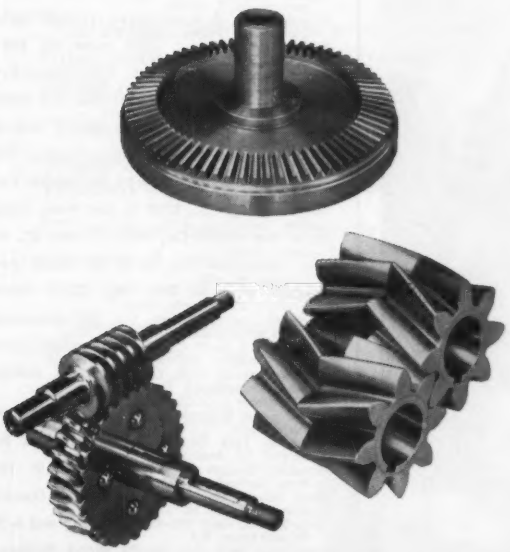

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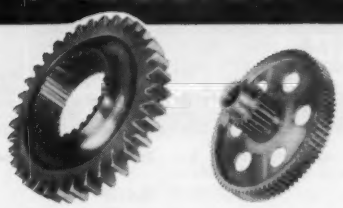

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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

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Cosa Corp., 405 Lexington Ave., New York 17.
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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

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Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

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Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Lees-Bradner Co., Cleveland, Ohio
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
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Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

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Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
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(*Continued on page* 344)

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Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
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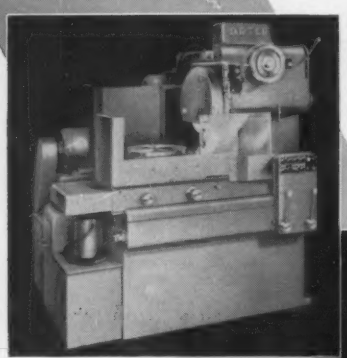

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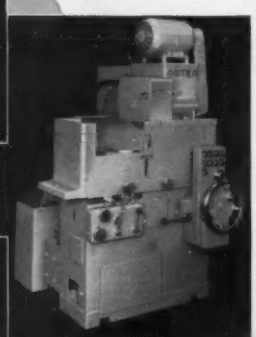

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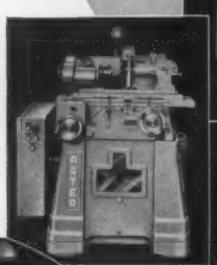
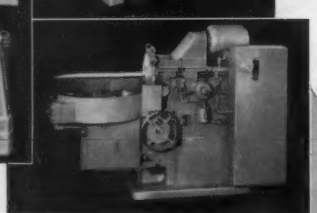
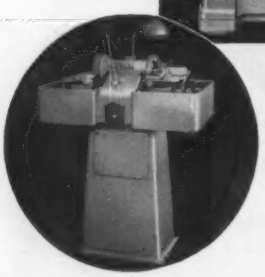
MODEL 103—CYLINDRICAL AND INTERNAL GRINDER







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Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

GRINDERS, Portable Electric and Toolpost

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

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Geometric Tool Co., (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

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Atlas Press Co., Kalamazoo, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

GRINDING MACHINES, Broach

Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
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(*Continued on page* 346)

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Willey's Carbide Tool Co., 1340 W. Vernon Hwy., Detroit 1, Mich.

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Cincinnati Grinders, Inc., Cincinnati, Ohio.
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Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

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Baird Machines Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

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Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Drill

Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobbs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

(*Continued on page* 348)

SHELDON
CHICAGO U.S.A.

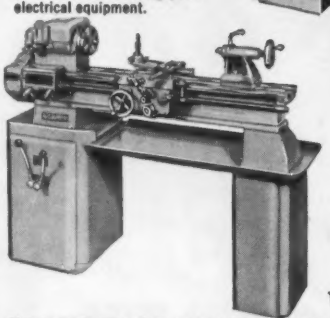
MORE POWER at the Spindle Nose

The greater work capacity of 10", 11" and 13" Sheldon Precision Lathes comes in part from their extra power. Compared to other lathes of similar swing and price, Sheldon Lathes are built to take larger motors. Sheldon Motor drives are better engineered and better built. In place of a single ordinary V-belt to drive the lathe spindle, these Lathes have twin, Neoprene, cog V-belts (each capable of delivering 40% more power than an ordinary V-belt).

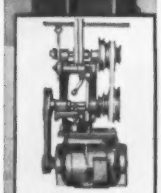
The greater wrap-around of Sheldon's twin cog V-belts not only delivers more power at the spindle nose—permitting heavier cuts, they also eliminate slippage at the spindle—increase accuracy of work.

Made of oil, heat and static resistant Neoprene, Sheldon's Spindle belts have a longer life expectancy than other belts of similar type.

EM56B—with 4-speed Type E, Underneath Motor Drive in Cabinet base. $1467.00 F. O. B. Chicago, less electrical equipment.



UM56P—with 4-speed external lever shift type U, underneath Motor Drive in heavy cast iron Pedestal base with storage space in tailstock leg. $1434.00 F.O.B. Chicago, less electrical equipment.



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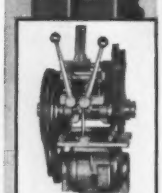

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You are missing a bet!

Use U.S. DRILL HEADS with Turret Lathes...

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Multiple Spindle Drill Heads have many uses, yet oftentimes they are not considered as being applicable to automatic turret lathes.

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Write or wire us today. There's no obligation, of course, and the chances are that we can save you time and money.

Manufacturers of all types of fixed center and individual lead screw tapping heads.

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Since 1915

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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Moore Special Tool Co. Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear Blade

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

GRINDING MACHINES, Piston Ring

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Radial

Consolidated Mch. Tool Corp., Rochester, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Cincinnati Miling Mch. Co., Oakley, Cincinnati 9, Ohio.
Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

Abrasive Mch Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

(*Continued on page* 350)

NEW L&J NO. 7 PRESS

RIGID – ACCURATE – EFFICIENT

– with a LARGER WORK AREA

This new press will give you greater production at lower cost. Its alloy iron frame has exceptional rigidity which holds deflection to a minimum and gives closer tolerances, greater uniformity and longer die life. Accuracy is also obtained through adjustable gibs of extra length. The rugged ram adjusting screw has buttress threads and replaceable hard bronze seat. Air clutch optional. Geared and non-geared models.

Write for Catalog

Fully describes all L&J O.B.I. Presses—21 geared and non-geared models. Capacities 8 to 90 tons. Also, 20 to 50 ton High Speed, Double Crank Straight Side Presses with speeds up to 450 s.p.m. Ask for Catalog.

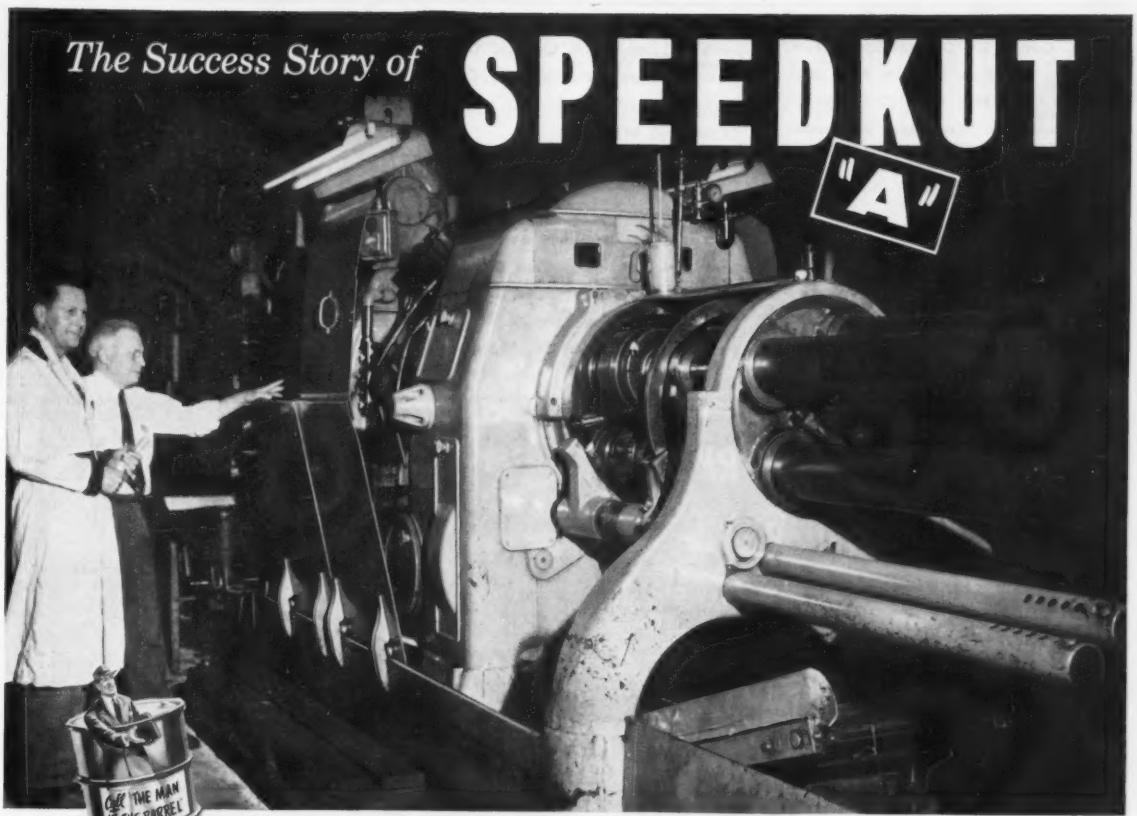
SPECIFICATIONS

Capacity—75 tons. **Standard Stroke**—4". **Maximum Stroke** (to order)—8". **Strokes** per minute—42 (non-geared type 85). **Throat Depth** center of ram to frame—13½". **Die Space***—14" to 22". **Bolster Plate Area**—36" x 26".

* bed to ram, standard stroke down, adj. up.

L&J PRESS CORPORATION
1631 STERLING AVE., ELKHART, INDIANA

The Success Story of SPEEDKUT "A"



. . . *a boost for screw machine output!*

The Success of SpeedKut A . . . is an oft repeated story of increased output, better tool life and less downtime. For SpeedKut A is one of Stuart Oil Company's balanced, general purpose cutting oils specifically designed for high speed machining of free-machining screw stock and brass on single spindle and multiple spindle automatic screw machines, turret lathes, milling machines, and hobbing machines.

SpeedKut A is a product of Stuart's sulphochlorination processing that provides absolute uniformity and stability. Highly effective chemical additive materials are pre-balanced under strict laboratory supervision to instill SpeedKut A with the anti-weld and friction reducing characteristics necessary to the range of machining operations for which it is recommended.

When selecting a cutting fluid, factors to be considered are material being machined, material hardness, speeds, feeds, depth of cut and machine design. Cullman Wheel Company, Chicago, Ill., a leading sprocket manufacturer, took all these factors into consideration more than 10 years ago. They chose SpeedKut A then and still use it for their multi-spindle automatics to cut sprocket blanks from free machining bar stock and for hobbing the sprocket teeth.

Your operation may be another link in this success story of SpeedKut A . . . or perhaps the factors that must be considered indicate a different type of balanced cutting fluid. "The Man in the Barrel", your Stuart Representative, will help you take all of the factors into consideration. Consult him. You'll be happy you did.

Write for Stuart's Cutting and Grinding Fluid Selector and Dilut-O-Graph Folder. It's a quick guide to starting recommendations for any job. Your name and title on a company letterhead is all that's needed.

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2739 S. Troy St., Chicago 23, Ill.

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Time Tested Cutting Fluids and Lubricants

Plants in: Chicago, Detroit, Cleveland, Hartford, and Toronto, Ontario.

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For more information on products advertised, use Inquiry Card, page 239

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Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.

GRINDING MACHINES, Worm

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
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- Automatic Indication of Angle and amount of unbalance with the Electodyne system—an Olsen exclusive.
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Chambersburg Engrg. Co., Chambersburg, Pa.
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Standard Pressed Steel Co., Jenkintown, Pa.

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National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

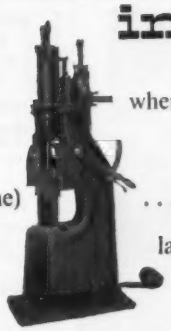
HOIST HOOKS

Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page* 352)

Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.

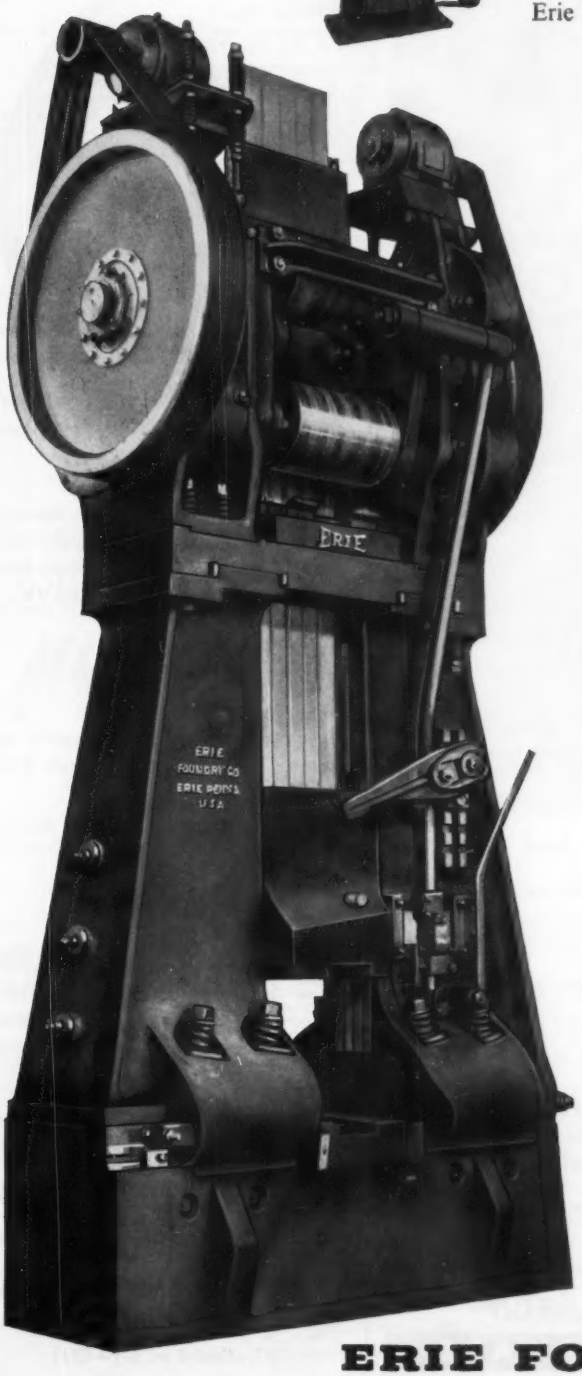
in the good old days



(such as this 100 lb. single frame)

when Erie Foundry was *the first* to use all-steel construction in all our hammers

. . . . . and when hammermen thought a board drop hammer larger than 5,000 lbs. was a wild dream . . . . even then Erie Foundry was a great name in forging hammers



today

Erie Foundry has recently built the world's largest board drop hammer. This 10,000 lb. hammer is at work for Eaton Manufacturing Co's Marion, Ohio forge plant. Eaton is forging 68 lb. net, Flat Back Ring Gears, 16" in diameter, in a single impression die, straight down without blocking or pancaking.

In addition to forging large gears speedily, Eaton likes the Erie 10,000 lb. Board Drop Hammer because the 4-roll lifting head gives longer board life. Air operated board clamps ease the hammerman's job.

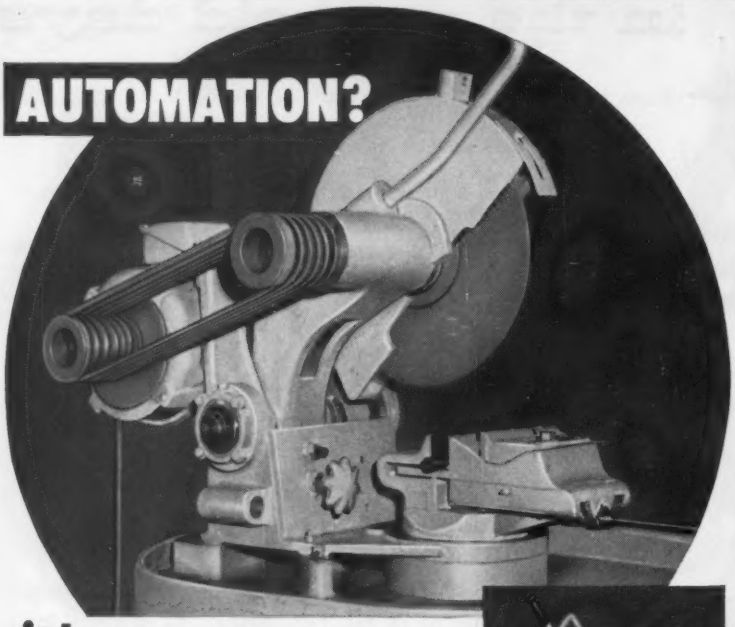
As in the good old days, this 10,000 lb. board drop hammer is all-steel . . . and made by Erie.

in our 60th year

ERIE

The Greatest Name in Forging Hammers

ERIE FOUNDRY CO. ERIE, PA.



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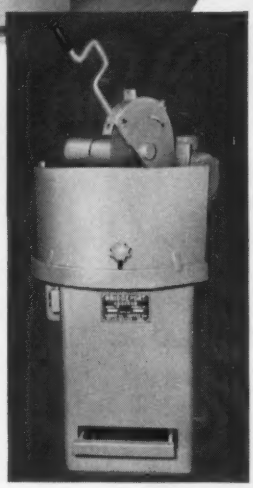
TO ANY DEGREE WHEN YOU *specify* THIS

MODEL 48-W BRIDGEPORT ABRASIVE CUT-OFF MACHINE



Here's why . . .

- Air cylinder and hydro-check actuates head . . . saves labor and reduces wheel costs. (16" dia. wheel).
- Vise operates by air cylinder . . . integrated head, vise operation is excellent safety feature.
- Feeding mechanism which grips material to be cut, moves it into position.
- A series of micro switches tie above operations into smooth cycle which repeats automatically.
- Stainless steel spindle with Grease Sealed bearings.
- Coolant applied equally to both sides of cut.
- Vise holds *both* ends of piece being cut.
- Abundant power supplied by 7½ H.P. motor.
- Swivel head for accurate angle cutting.
- Accurate counterbalance of head by location of motor.
- Heavyweight for long life and efficient operation.
- *Complete automation* produces close tolerances, increases production, saves labor.

LOBDELL has a *complete line* of BRIDGEPORT Cut-Off Machines to suit every need. *Write for further details.*

LOBDELL DIVISION

UNITED ENGINEERING AND FOUNDRY COMPANY

WILMINGTON 99, DELAWARE

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Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric

Philadelphia Gear Works Inc., Erie Ave. and G St., Philadelphia, Pa.

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Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

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Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

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Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.

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Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

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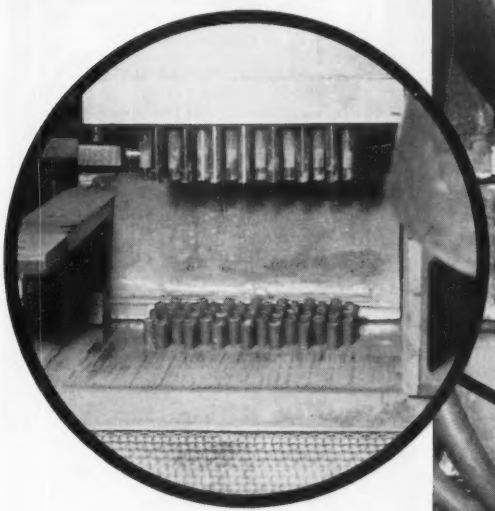
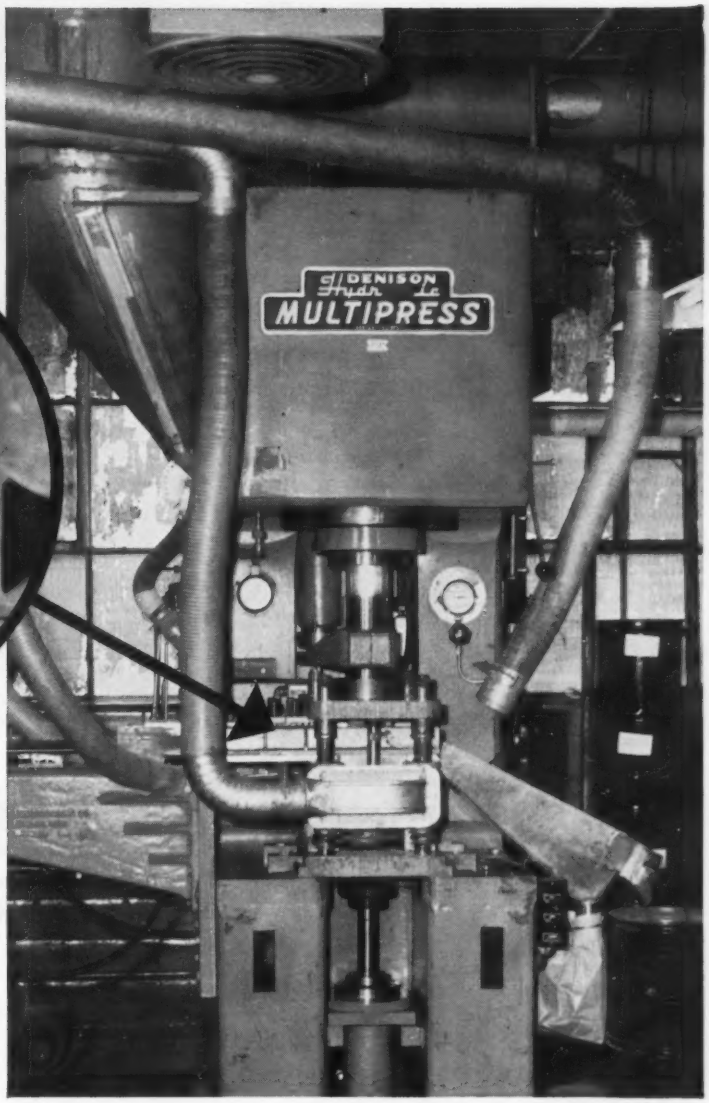
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.

(*Continued on page* 354)

Compacts 40,000 tablets an hour





...automatically with DENISON MULTIPRESS®

an idea that simplifies many compaction jobs ... to save you money

52 TABLETS PER CYCLE coming off multiple-cavity die after compaction on Denison hydraulic Multipress. Tablets come down chute, are collected and coated.

52 tablets compacted with every ram cycle add up to 40,000 tablets an hour. That's what's turned out on a Denison hydraulic Multipress at this leading pharmaceutical company.

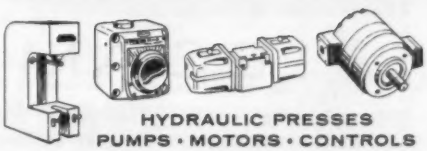
The entire operation is automatic. Results are uniform, cost is low.

Hoppers feed powder to a Denison Shuttle Feed Accessory that loads a multiple-cavity die. Two rapid, precision pressure controlled strokes of the Multipress ram compact the powder into tablets.

Many operations of compacting powdered materials can now be done faster, simpler . . . at substantial reductions in cost with Denison hydraulic Multipress and accessory equipment. Have a Denison Engineer study your operations and demonstrate how. Write.

THE DENISON ENGINEERING COMPANY
1244 Dublin Road • Columbus 16, Ohio
A Subsidiary of American Brake Shoe Co.

DENISON Hydr-OIL-ics



HYDRAULIC PRESSES
PUMPS • MOTORS • CONTROLS

For more information on products advertised, use Inquiry Card, page 239

. . . the preferred dial indicators

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For more than half a century, industry has relied on Ames indicators for help in the solution of measurement problems of all kinds. And through the years, Ames indicators have done their jobs superlatively well. The Ames reputation for extreme accuracy, ruggedness and reliability through many millions of cycles is due to an unswerving dedication to our original guiding principle—to make the best possible indicators and gauges, through constant research and the use of highest quality materials and expert craftsmanship.

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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

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Barnes, John S., Corp., Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

INDEXING AND SPACING EQUIPMENT

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

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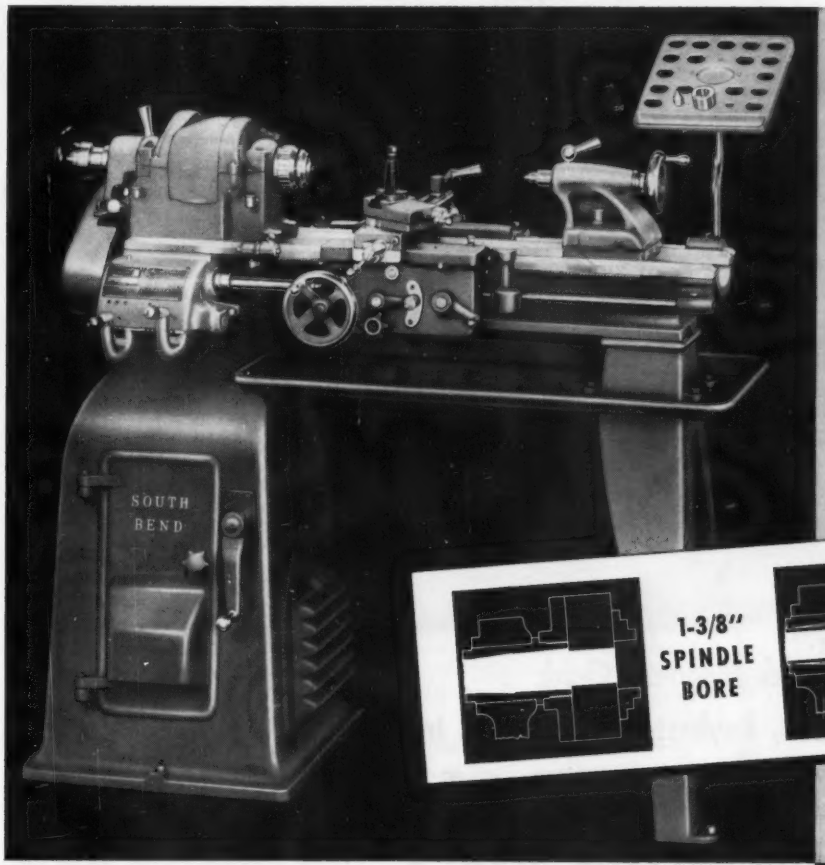
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Micrometrical Mfg. Co. (Surface roughness & waviness), 321 S. Main St., Ann Arbor, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

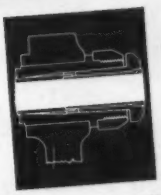
General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio

(*Continued on page* 356)



SOUTH BEND 10" Lathes

1-3/8" SPINDLE BORE



1" COLLET CAPACITY

10" *Precision* TOOLROOM LATHE

Sound design, expert workmanship and quality materials give the 10" South Bend Lathe the dependable performance you want. Equipped with a precision lead screw, thread dial indicator and thread cutting stop, you can use it with confidence for cutting screw threads, making precision gauges or turning out instrument parts.

Another outstanding feature is the 1" collet capacity and 1-3/8" spindle bore which is built on the same design and specifications of larger lathes. The large spindle bore gives you big lathe collet capacity in a small, compact unit.

You will like the way this lathe cuts idle time . . . reduces costs . . . releases big lathes for heavy work. Write for catalog *today*.

SPECIFICATIONS

SWING 10⅛" over bed and saddle wings, 5¾" over cross slide.
COLLET CAPACITY.....1 in.
SPINDLE BORE.....1⅜ in.
BED LENGTHS....3, 3½, 4 ft.
CENTER DISTANCES...14¼ in. to 26 7/8 inches.
SPINDLE SPEEDS...(12) 55 to 1400 r.p.m., approximately.
POWER LONGITUDINAL FEEDS 70 R.H. or L.H....0007" to .0836".
POWER CROSS-FEEDS 70.... .0003" to .0303".
THREAD CUTTING 70 R.H. or L.H. pitches, 4 to 480 per inch.
MODELS Quick Change Gear and Toolroom, bench and floor type.

Compared with our costs
OUR PRICES ARE LOWER
than they were back in 1941

Prices are closely tied to costs. Costs are still rising. Buy now before increased costs necessitate higher prices.

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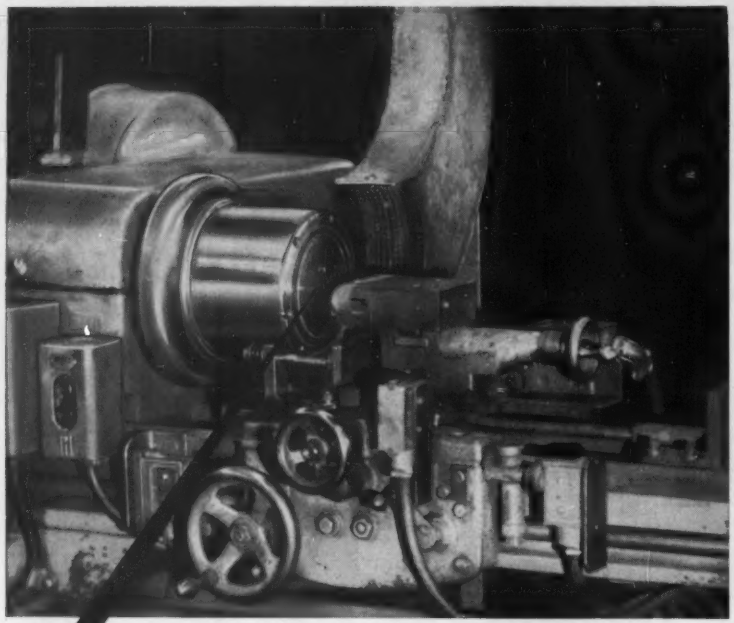

Magna-Lock Magnetic Chuck

at Wabash Division, Raybestos-Manhattan, Inc.

SOLVES PROBLEM OF HOLDING THIN WORK-PIECE

THE JOB: Machining spiral groove .030″ wide, .015″ deep with 1/16″ space between grooves on steel plate faced with copper friction material.

THE PROBLEM: To hold 1/16″ thick copper-faced steel plate firmly on a lathe during the grooving operation.

THE SOLUTION: A Hanchett MAGNA-LOCK Rotary Magnetic CHUCK holds work piece which is machined at a spindle speed of 600 RPM.

THE RESULT: 2,400 pieces machined per 8-hour shift. Scrap and rejects run less than 2%.

Here you have another example of how Hanchett Magna-Lock Magnetic Chucks can increase your machine's productivity.

Magna-Lock offers a complete line of rotary, rectangular, swiveling and vertical face magnetic chucks, magnetic sine chucks, parallels and accessories. Magna-Lock Rectangular Chucks have 22% more magnetic area, permitting work pieces to be held to the extreme edges of the chuck. They are of welded *all-steel* construction, shock-proof and moisture-proof.

Get Magna-Lock for extra holding power that holds an extra margin of profit for you! WRITE TODAY, Dept. M-115.

Request Magna-Lock as original equipment on your new machines.

Hanchett **MAGNA-LOCK CORPORATION**

Magnetic Chucks and Devices

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Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.

JACKS, Machine Leveling
Enterprise Mch. Parts Corp., Detroit, Mich.

JACKS, Planer
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

JIG BORER
See Boring Machines, Jig

JIGS AND FIXTURES
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

JOINTS
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KEYS, Woodruff, Machine, Special
Standard Automotive Parts Co., 660-668 Nims St., Muskegon, Mich.

KEYSEATERS
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio
Consolidated Mch. Tool Co., Rochester, N. Y.
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Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

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Pratt & Whitney, West Hartford 1, Conn.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

(*Continued on page* 358)

Logan air valves

A model to effectively meet practically any air control valve requirement.
Designed to assure maximum efficiency with a minimum of maintenance.

Model 6550
Air Control Valve

82 models

most models stock delivery

Logan Air Control Valves are designed and built to assure an unusually high standard of performance plus maximum convenience for the design engineer, machine operator and maintenance man. Every construction detail has been planned to make Logan valves easy to install, to use and to service.

Thousands of manufacturers have found Logan valves to be the answer to their production problems. Logan engineers are at your service to help you achieve better, more efficient production. Following are a few facts about Logan Air Control Valves:

Standard valve models are available in a wide range of mounting types, means of actuation, type of handle and sizes.

Can be located in any position on horizontal, vertical or other surfaces. Mounting is simple.

Construction is compact—permits installation in limited space, close to other equipment.

All valves are built for operating pressures to 150 psi. For reuse, many Logan valves can easily be converted to other types. Parts are interchangeable.

The wide choice of types of control makes it possible to provide the most convenient type of actuation for every problem of regulation.

Effortless control is provided in all models. Balanced construction produces equal pressure on both sides of piston.

Valve piston is light in weight, permitting high-speed operation without excessive vibration or wear.

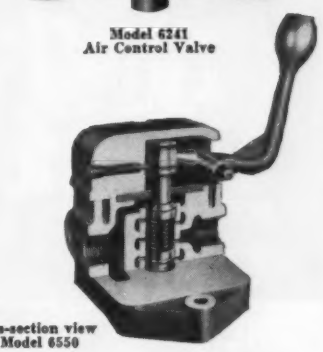
Long-life synthetic rubber cup packings on valve piston assure positive action without leakage.

Piston-type valve with sliding piston eliminates valve seats; minimizes wear.

Self-cleaning construction means longer sealing life.

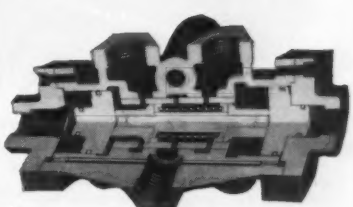
Valves are unusually easy to repair or recondition. Simply by removing cover screws—covers and valve piston can be quickly removed and replaced.

If a few spare pistons are carried in stock, a Logan air valve can be reconditioned with only a few minutes of downtime. Write for Logan Catalog 100-4.



Model 6241
Air Control Valve

Cross-section view
of Model 6550



Cross-section view
of Model 6241

Let Logan Engineers help you design your Air and Hydraulic Circuits. No obligation.

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LOGAN MANUFACTURES 7,023 STANDARD CATALOGED ITEMS

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AIR and HYDRAULIC PRESSES, Cat. 51 • COLLET GRIP TUBE FITTINGS, Cat. 200-5 • HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62

SAVES TIME
Logan
AIR AND HYDRAULIC EQUIPMENT
EFFORT • MOTION

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LATHE AND GRINDING DOGS

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Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHE ATTACHMENTS

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio
Sundstrand Mch. Tool Co., 2431 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Automatic

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Axle

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Levin, Louis & Son, Los Angeles 21, Calif.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Sidney Machine Tool Co., Sidney, Ohio

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

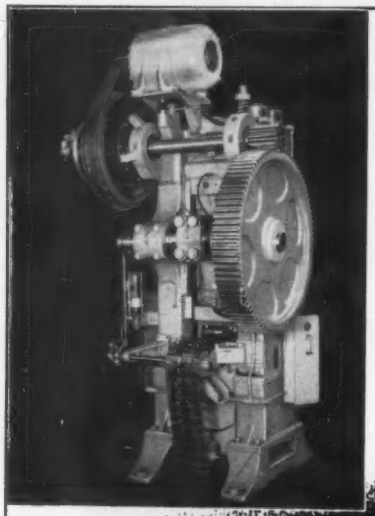
LATHES, Double-End

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Duplicating

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Hydro-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Sidney Machine Tool Co., Sidney, Ohio

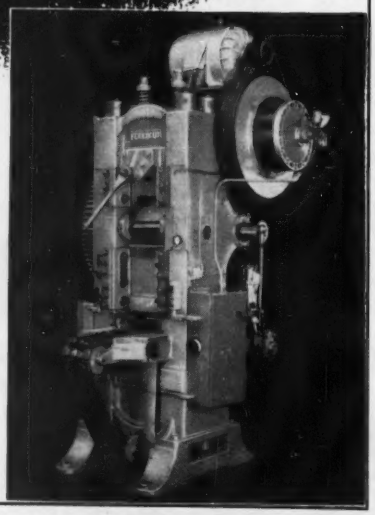
(*Continued on page* 360)



FERRACUTE

FERRACUTE E-401 EMBOSSING PRESS ELIMINATES EXPENSIVE MILLING OPERATIONS FOR AUTOMOTIVE MANUFACTURER

FERRACUTE EMBOSSING PRESS E-401, 400-TON MODEL



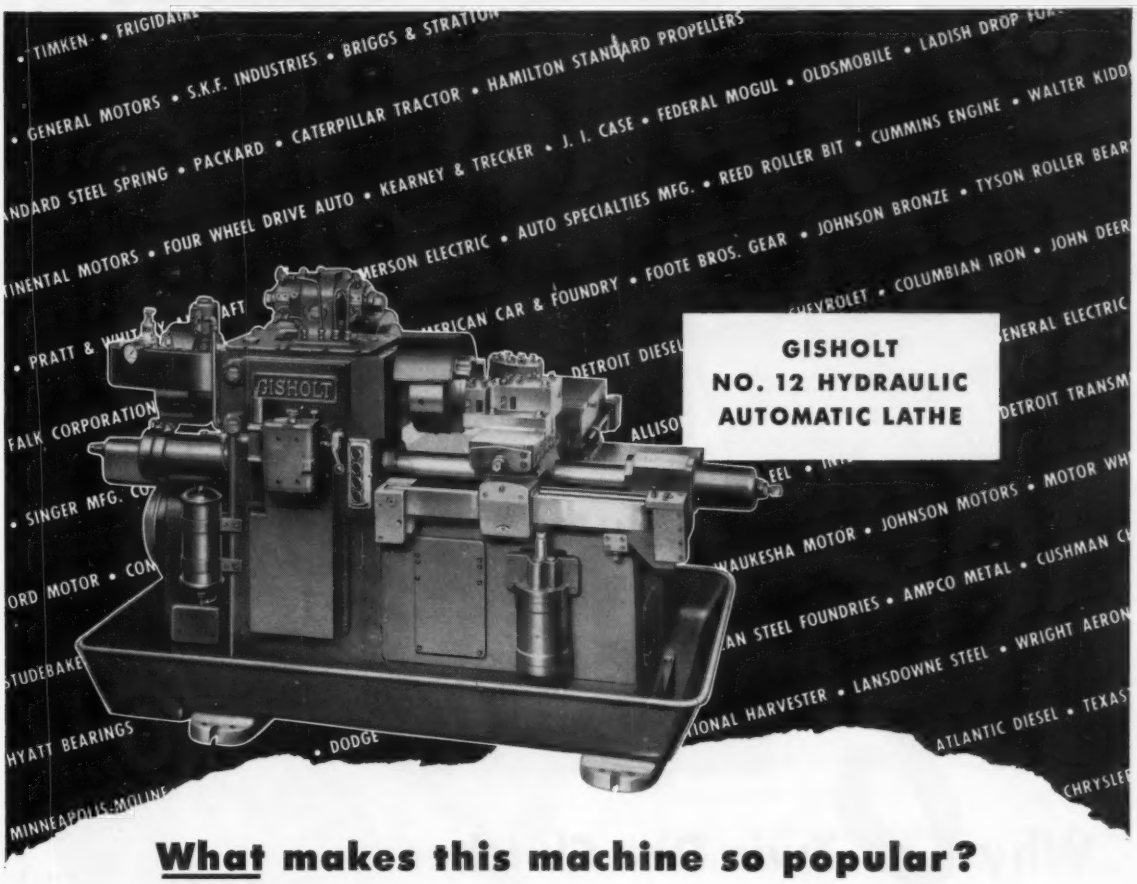
Produces rocker arms for intake and exhaust valves two at a time—30 strokes per minute—total production 3,600 pieces per hour. Ferracute top toggle, tie-rod construction Embossing Presses are available in a complete range of sizes from 150-ton to 1,500-ton. Ruggedly constructed and extremely powerful, these presses may often be used to move the metal cold and thus replace costly milling operations.

Our engineers will be glad to survey your production with an eye to similar economies. Write for complete information.

Ferracute Machine Company

Since 1863 Manufacturers of Power Presses, Press Brakes, and Special Machinery

Bridgeton, New Jersey, U.S.A.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IONAL HARVESTER • LANSDOWNE STEEL • WRIGHT AERON
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What makes this machine so popular?

It's the simple basic application of hydraulic principles—perfected through the years. It's a single spindle machine that handles all classes of work—holding with a chuck or an arbor, with fixtures, or with a work driver for between centers. Front carriage alone will perform 14 different cycles. Independent rear slide can be positioned at any angle to the work. Feeds are infinitely adjustable...not limited by cams. Here's the versatility, the speed, the automatic cycle, and the easy change-over that mean big savings for scores of users. Why not for you?

If you have parts up to 12″ to produce at lower cost, look at the Gisholt No. 12 Hydraulic Automatic Lathe. Call your Gisholt representative. Or write us.

This new catalog will show you why.

All operating features are clearly described, fully illustrated. Here, too, are 28 different jobs to show many classes of work and tooling possibilities. Write for your copy.

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES
SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Gisholt Machine Company
Madison 10, Wisconsin

Please send my copy of the catalog describing the Gisholt No. 12 Hydraulic Automatic Lathe.

Name.....*Title*.....

Company.....

Address.....

City.....*State*.....

Model MOD OIL-ACTUATED Multiple Plate Clutch (inset) is one of 6 Twin Disc Machine Tool Clutches incorporated in this power driven 8' Rotary Table with 50-ton capacity—manufactured by one of the world's largest machine tool makers, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

Why 6 Twin Disc Clutches are *standard* on new Giddings and Lewis Rotary Table

For *more constant* torque transmittal . . . *longer* wear life . . . *adequate* capacity in a small package . . . *elimination* of adjustment . . . and remote control at *minimum cost*—Giddings & Lewis uses *six* Twin Disc OIL-ACTUATED Multiple Plate Clutches as standard equipment for their new power driven 8' rotary table with 50-ton capacity. Included are: (1) Model MOD-806 and (2) Model MOS-806's on feed drive, with (3) MOS-806's on main transmission.

The Models MOS (single) and MOD (duplex OIL-ACTUATED Multiple Plate Clutches are Twin Disc's answer for a high energy, high inertia, high horsepower clutch especially adaptable to applications creating high temperatures and operating under heavy, abusive loads.

Both models are readily adaptable to remote or push button control without mechanical linkage. Since the floating or pressure plate forms the ram of the cylinder, ram travel increases automatically as plate stack wears. This eliminates adjustments to compensate for plate wear and constant torque transmitting ability is thus provided during entire life of clutch plates.

Find out how these OIL-ACTUATED Multiple Plate Clutches can be applied to your machines—write today to Twin Disc Clutch Company, Racine, Wis.

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

TWIN DISC
Clutches

LATHES, Engine and Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio

LATHES, Gap

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio
Springfield Mch. Tool Co., Springfield, Ohio
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Gun

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Machine Tool Co., Springfield, Ohio

LATHES, Hollow Spindle

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

See Lathes, Engine and Toolroom

LATHES, Turret

Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc. (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

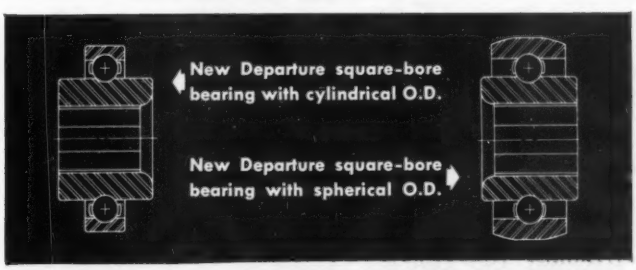
(*Continued on page* 362)

FACTS

about

NEW DEPARTURE

BALL BEARINGS



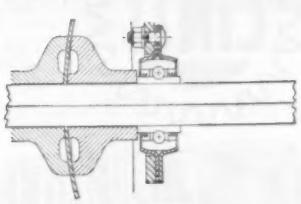
Square-bore bearing cuts costs for disc harrow manufacturers!

New Departure's new square-bore ball bearing mounts directly on square axles, cutting costly machining operations on adapter spools and eliminating inner ring slippage. The design permits use of a smaller bearing, and fewer, less expensive mounting components are needed.

Precision ground areas on the bearing provide ideal contacting surfaces for installation of triple-lipped seals, assuring full protection under the most stubborn dirt conditions. Lubricated for long, hard service, maintenance requirements are reduced to virtually zero. Write for full details.

TYPICAL APPLICATION OF NEW DEPARTURE'S SQUARE-BORE BALL BEARING

Shown at the right is a New Departure square-bore ball bearing, with spherical O. D., mounted on the square shaft of a disc harrow. This is a typical example of how New Departure meets the special needs of industry by designing, developing and manufacturing the right bearing to fit the specific job. Call on New Departure for help in solving your bearing problem.



NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

For more information on products advertised, use Inquiry Card, page 239

500 Gears . . .

DOWN THE DRAIN

PRESIDENT, THE CINCINNATI GEAR CO.

We don't like to admit it, but we make our share of mistakes. Fortunately, these do not occur too often but when they do, we see to it that they do not reach you, our customer. Before any gear leaves our factory, it goes through a tough final inspection. Each of our highly trained inspectors checks the work as if he were the inspector in the customer's plant. These men answer only to me, thereby eliminating any possibility of influence that might be exerted by those interested only in production.

Recently when we were manufacturing a large order of bronze worm gears, a very serious error was inadvertently made during the manufacturing process. In spite of constant vigilance, this was not discovered until the gears reached final inspection. The boys sure found it at that time. Actually the error amounted to the fact that the teeth had been cut about .010 too deep. While it might have been possible to make the mating worms oversize, this thought was the farthest from our minds. Because the worm gears were NOT correct, they were scrapped and replaced. The loss resulted in one of the largest single scrapped orders that we ever had. It hurt.

We believe that our ardent will to supply gears of only the highest quality pays off. Our customers have the assurance that when they receive gears from CINCINNATI GEAR, these have been through a rigid and thorough inspection and are ready for assembly. Our men understand that there is "no compromise with quality," and that is the policy under which they operate. We also believe this is the least costly for our customers because once they receive our gears, they know there will be no "hidden" costs during assembly.

THE CINCINNATI GEAR CO.

CINCINNATI 27, OHIO

"Gears — Good Gears Only"

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LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Potter & Johnson Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Vertical Turret

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.

LAYOUT FLUID

Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS

Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wyler, Max, 611 W. 43rd St., New York 36, N. Y.

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Arter Grinding Machine Co., 15 Sagamore Rd., Worcester 5, Mass.

LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants

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Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Socony Mobil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

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Farval Corp., 3249 E. 80th St., Cleveland, Ohio
Madison-Kipp Corp., Madison, Wis.
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Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MAGNETIC BASES FOR INDICATORS

du Mont Corp., Greenfield, Mass.

MANDRELS

See Arbors and Mandrels.

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Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.

MEASURING MACHINES AND INSTRUMENTS, Precision

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio
Crane Packing Co., 1800 Cuyler Ave., Chicago
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Max Wyler, 611 W. 43rd St., New York 36 N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR

Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

METAL, Bearings

See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.,

METAL FINISHINGS

Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

METERS

See Recording Instruments

MICROMETERS

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MICROSCOPES, Toolmakers

Scherr George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

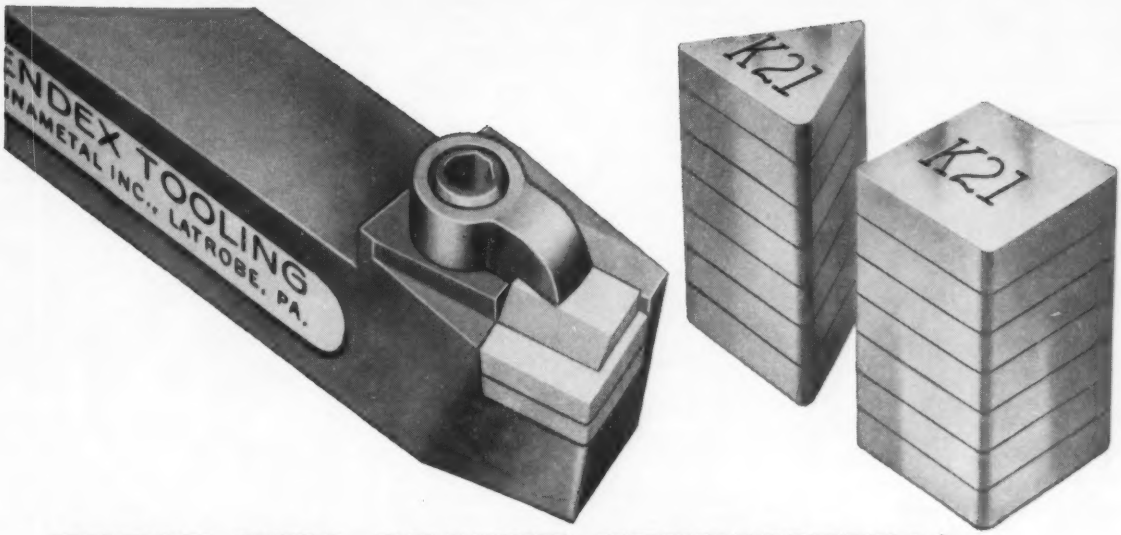
MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.

(Continued on page 364)



THESE TWO RECENT KENNAMETAL* DEVELOPMENTS HELP TO MEET TODAY'S HIGH-SPEED PRODUCTION NEEDS

The profit advantages of today's high-speed automatic cycling machines for metal cutting are lost when tools wear rapidly—need frequent regrinding—or are cumbersome to index.

Kennametal recently introduced two new developments to help give you continuous machine performance, and to help step up profits in your steel-cutting operations. These developments are Kendex*† Button Tooling and Kennametal Grade K21.

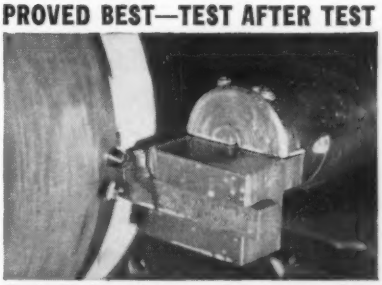
Kendex "turnover" inserts, with replaceable Kennametal shims and new chip control system, double the number of cutting edges, eliminate all regrinding and index in seconds. These features help provide consistent tool performance and hold downtime to a minimum.

Grade K21 is the General Purpose steel-cutting carbide now outperforming all other medium grades in the carbide industry. Superior performance of K21 is due to exceptionally high edge strength, strong resistance to cratering and superior wear qualities. An extremely versatile grade, K21 can be applied to general steel-cutting, heavy roughing and finishing.

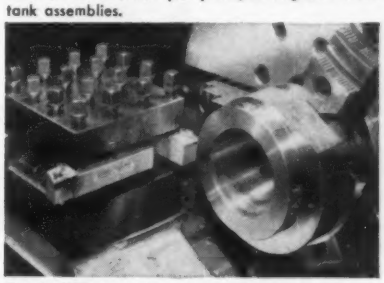
Kendex, in 17 styles and sizes; and K21, in popular blanks and inserts, are immediately available from stock. For their right application on your machining jobs, call a Kennametal Tool Engineer. He works exclusively with Kennametal . . . applying and servicing it. And be sure to ask for reports of Kendex and K21 repeat performances, job after job. KENNAMETAL INC., Latrobe, Pa.

*Registered Trademark †Patent applied for 9403

PROVED BEST—TEST AFTER TEST



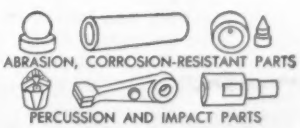
Kendex Tooling with "turnover" inserts cuts tool cost from $1.20 to $0.09 per piece, turning SAE 4140 tank assemblies.



Grade K21—on interrupted cutting, roughed and finished 6 times as many pieces as other premium carbide.

Give your machines the tools they deserve . . . the BEST

INDUSTRY AND
KENNAMETAL
. . . Partners in Progress



MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., Milwaukee, Wis.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co. 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Profile

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Burke Machine Tool Div., Cincinnati 27, Ohio.

MODEL AND EXPERIMENTAL WORK

See Special Machinery and Tools

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Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

MOLDING MACHINES, Plastic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

MOTORS, Electric

Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Howell Electric Motors Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

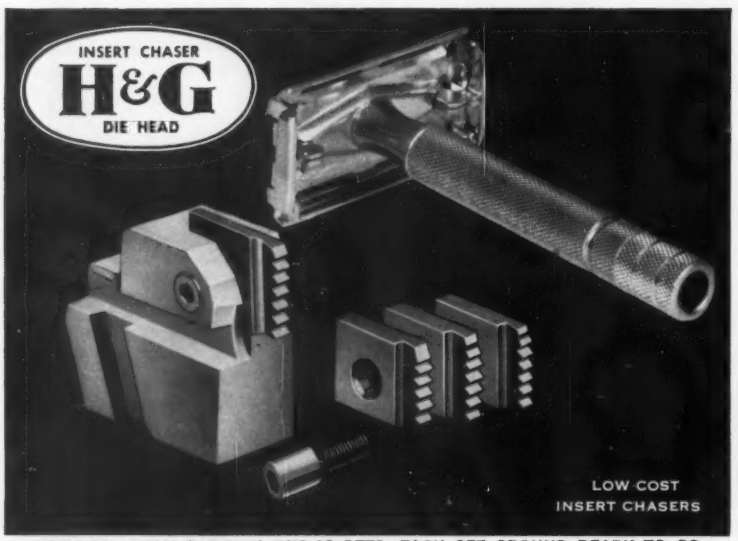
MOTORS, Hydraulic

Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

(*Continued on page* 366)



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INSERT CHASERS SAVE UP TO 33%

Insert chasers are like safety razor blades: they cost so little that you can throw them away when dull. Or, for utmost economy, you can resharpen them over and over again. Only a flash grind is required. For less than $40 you get a dozen sets of ¾–16 insert chasers, each set ground ready to go. You will be amazed at the quantity of threads they will cut, even to Class 3 specifications, with a minimum of downtime.
FREE: "Unified and American Screw Thread Digest."

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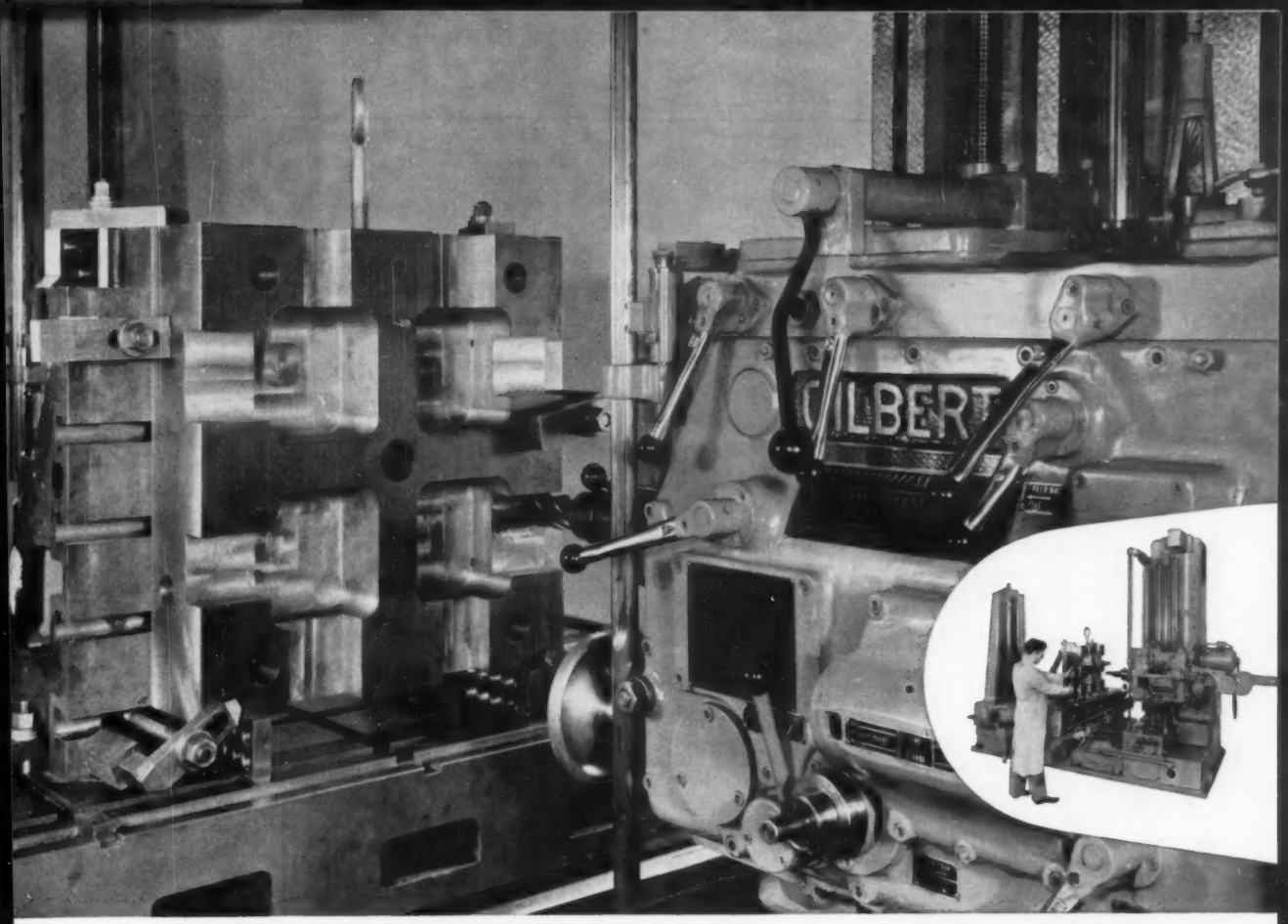

courtesy Mohawk Tool & Die Corporation and Macaulay Machinery Co.

30 percent savings and ±.001"

...match it with a Gilbert

How's this for a perfect lineup: 30% savings in floor-to-floor time over previous machines, and ±.001" for mating the two chases of a four-cavity carburetor bowl mold.

Mohawk Tool & Die Corp., Rochester, N.Y., gets these savings and accuracy by handling the job on a Cincinnati Gilbert horizontal boring mill.

Here the lower chase (of hot work die steel) is being rough machined. Then it's hardened to a Rockwell of 48-50C scale. Finally, the chase is finish machined with carbide to an accuracy of ±.001" for guide pin and bushing holes, four cavity pockets, and eight slide ways.

Says Mr. George Neward, Mohawk's Secretary-Treasurer: "This job illustrates the flexibility of this type of machine. The ruggedness and stability of the Cincinnati Gilbert has been proven to us without doubt."

The comparatively low cost of adding these advantages to your operations will surprise you. Write for new literature, or—better yet—get a proposal from Gilbert now.

The Cincinnati Gilbert Machine Tool Co.,
3366 Beekman Street, Cincinnati 23, Ohio

those who buy Gilbert buy **GILBERT** *again*

NIBBLING MACHINES
International Nickel Co., Inc., 67 Wall St., New York, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

NIPPLE THREADING MACHINERY
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUT SETTING EQUIPMENT
See Screw Driving and Nut Setting Equipment.

NUT TAPPERS
See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap
Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Union Drawn Steel Co., Div., Republic Steel Corp. Massillon, Ohio.

NUTS, Self-locking
Grip Nut Co., 310 S. Michigan Ave., Chicago 4, Ill.

NUTS, Thumb or Wing and Cap
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

OIL EXTRACTORS AND CLEANERS
De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

OIL SEALS
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS
Madison-Kipp Corp., Madison, Wis.

OILS, Cutting
See Cutting and Grinding Fluids.

OILS, Lubricating
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Socony Mobil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.

OILS, Soluble
See Compounds, Cutting, Grinding, Metal Drawing, Etc.

OPTICAL FLATS
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

ORDNANCE MACHINES, Spelial
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.

PAINTING EQUIPMENT, Spray
Lowe Bros. Co., Dayton, Ohio.

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

PIPE, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

PLANER ATTACHMENTS
Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

(*Continued on page* 368)

Ruthman GUSHER coolant pumps

Illustrated Stanat Model TA - 624 Combination Rolling Mill equipped with a Ruthman Gusher Coolant Pump.

Each Gusher Coolant Pump is precision built — a credit to the metal working machines in which they are installed. The dynamically balanced rotating assembly cuts vibration and wear to a minimum. Pre-lubricated ball-bearings require no further attention. There is no priming or packing necessary. Your Gusher Coolant Pump is a highly efficient precision machine.

Precision Built FOR EFFICIENT OPERATION

Model 11022

THE RUTHMAN MACHINERY CO.

1807 Reading Rd. Cincinnati, Ohio

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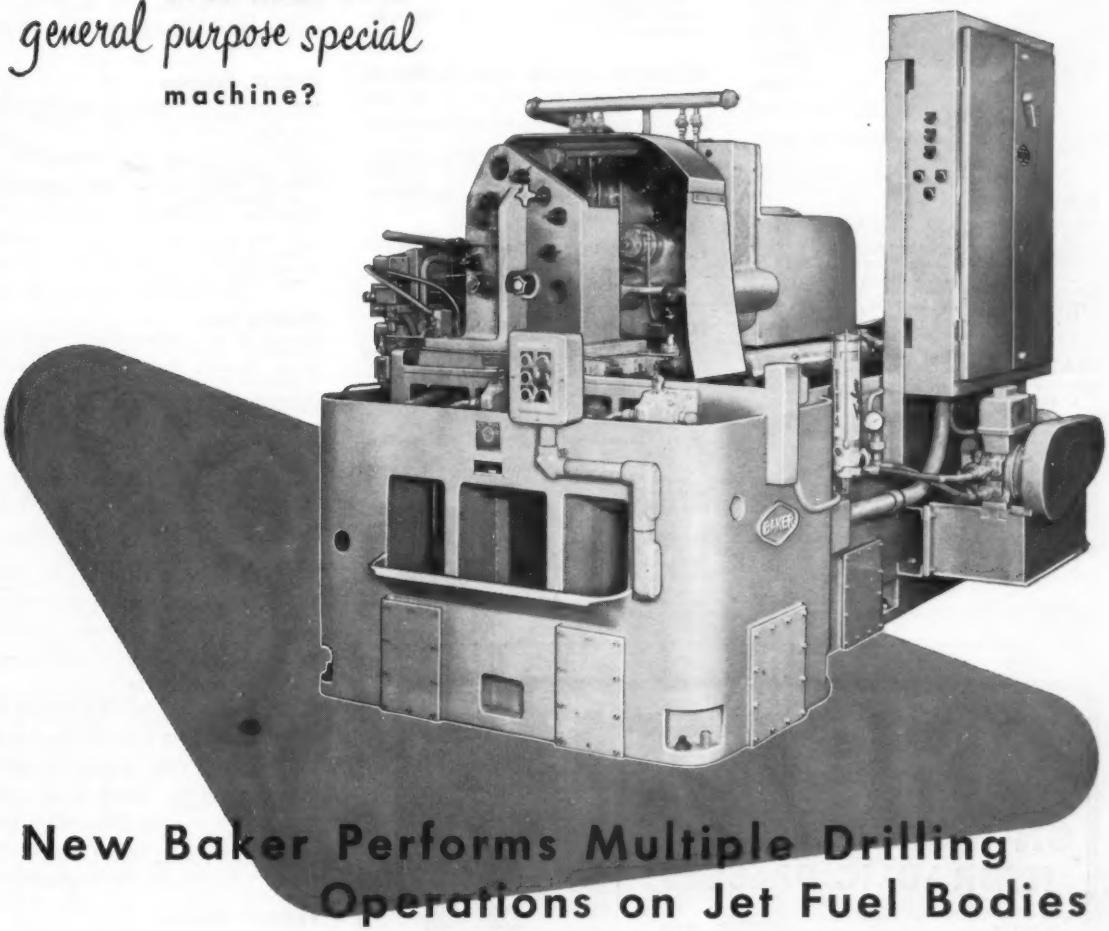
general purpose special

machine?



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- Head and fixture can be changed to meet newly designed product at minimum cost.
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- Selective operation for hand or automatic operation.
- Mist oiling on stationary bushings.
- Can be supplied with extra shuttle stations if needed.
- Twin pull cylinders (a Baker feature)
- Accurate positioning of shuttle *and* bars registering from head.
- Outside hydraulics, J.I.C. complete.
- Effective cooling of tools (see coolant distributor at top of machine)
- Rigidity throughout.

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WHATEVER YOUR DRILLING PROBLEM...THERE'S A BAKER THAT'S BETTER

BAKER BROTHERS, INC., TOLEDO, OHIO

DRILLING . . . TAPPING . . . KEYSEATING . . . CONTOUR GRINDING MACHINES

PLANERS

Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A. Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PLATE ROLLS

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Angle

Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.

PLATES, Surface

Brown & Sharpe Mfg. Co., Providence, R. I.
Challenge Machinery Co., Grand Haven, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

PNEUMATIC EQUIPMENT

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Onsrud Machine Works Inc., 3940 Palmer St., Chicago, Ill.

POLISHING LATHES AND MACHINES

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Millers Falls Co., Greenfield, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable

Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads

PRESSES, Arbor

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
duMont Corp., Greenfield, Mass.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Threadwell Tap & Die Co., Greenfield, Mass.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York, N. Y.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PRESSES, Foot

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel So., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Cch. Co. (Hydroform), Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co. (Hydroform), Cincinnati 9, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Detroit Broach Co., (special & semi-special) P. O. Box 156, Rochester, Mich.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Mch. & Welder Co., Warren, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.

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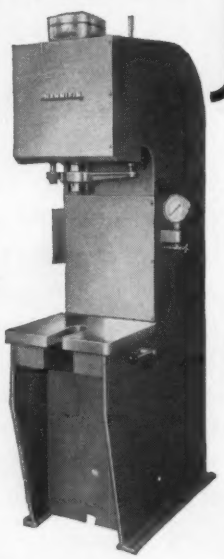
1-TON	$ 552
2-TON	$ 627
5-TON	$1,286
8-TON	$1,581
10-TON	$1,855
25-TON	$3,681

Prices complete with motors and starters F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.



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Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426, Clinton, Mo. (Bench)
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co. (Hydroform), Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 50, Ill.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Machine Works, Front St., and Girard Aves., Philadelphia, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Straightening

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Niagara Machine & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PROFILE—TRACING ATTACHMENTS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa. (Lathe).

PROFILING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George Machine Co., 1110 W. 13th St., Racine, Wis.
Morey Machinery Co., Inc., 383 Lafayette St., New York 3, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I.

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Pioneer Pump Div., Detroit Harvester Co., 14300 Tireman Ave., Detroit 28, Mich.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tompkins-Johnson Co., Jackson, Mich.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

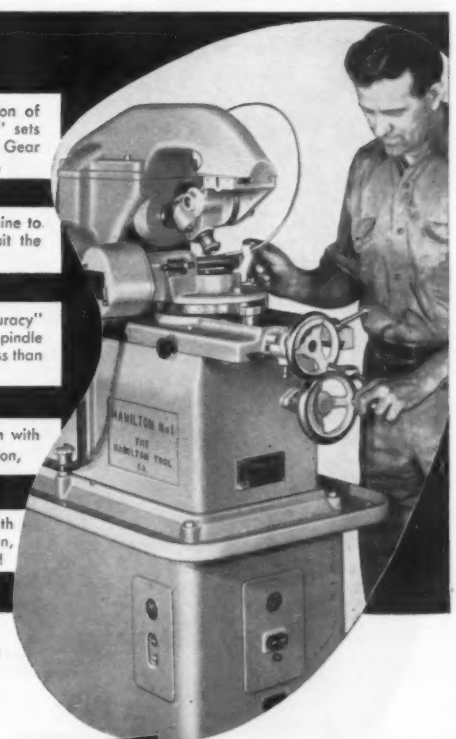
PUMPS, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

(*Continued on page 370*)

5410

NOW CUT COST OF PRECISION GEAR PRODUCTION



THIS FEATURE: "*Independent* selection of speed, feed and indexing," sets the Hamilton Precision Small Gear Hobber apart from the field,

AND ENABLES the users of this machine to vary speed and feed to suit the material being machined.

THIS FACT, and a "reserve of accuracy" built into the machine, work spindle and hob spindle runout of less than .0002" as an example,

CONTRIBUTES to more gear precision with no sacrifice of gear production,

OR INCREASED gear production with no sacrifice of gear precision, ... OR BOTH!

Prices and specifications without obligation

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Hamilton, Ohio

IT'S A Hamilton Tool
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Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1569 W. Pierce St., Milwaukee Wis.
Pioneer Pump Div., Detroit Harvester Co., 14300 Tireman Ave., Detroit 28, Mich.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Pump Div., Detroit Harvester Co., 14300 Tireman Ave., Detroit 28, Mich.
Sier-Bath Gear & Pump Co., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY

Allen, Alva F., Box 426, Clinton, Mo.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Engineering & Research Corp., Riverdale, Md.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

Ace Drill Corp., Adrian, Michigan.
The Atrax Co. (Carbide), 240 Day St., Newington 11, Conn.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Cabide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Jarvis Corp., Middletown, Conn.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Mohawk Tools, Inc., 910 E. Main St., Montpelier, Ohio.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

5403

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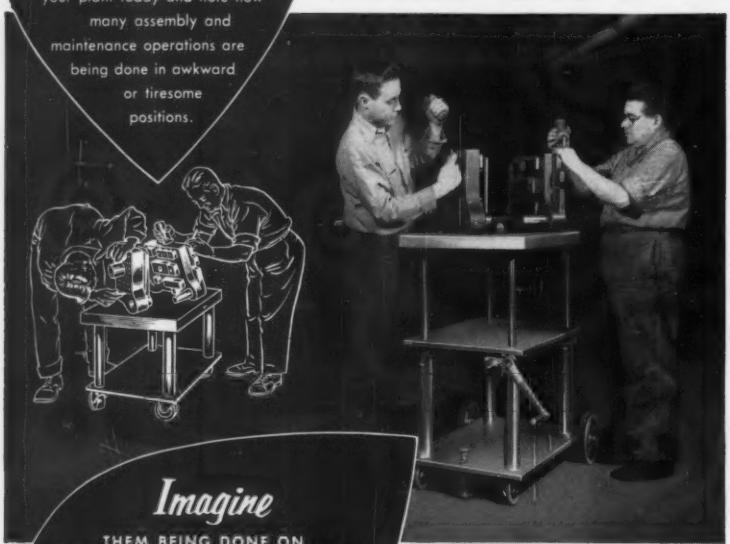
HARD WAY?

Take a trip through your plant today and note how many assembly and maintenance operations are being done in awkward or tiresome positions.



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IT'S A *Hamilton Tool*
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Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kaufman Manufacturing Co., Manitowoc, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

RECORDING INSTRUMENTS

National Acme Co. (for counting), 170 E. 131st St., Cleveland, Ohio.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

REELS, Stock, Standard and Automatic

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnace

Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature

General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.

Oakite Products, Inc., 19 Rector St., New York, N. Y.

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Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RHEOSTATS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

RIVET SETS

Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

RIVETERS, Hydraulic

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.

RIVETERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Wood & Co., R. D. Public Ledger Bldg., Philadelphia, Pa.

RIVETING MACHINES

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.

RIVET MAKING MACHINES

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

RUBBER PRODUCTS

Garlock Packing Co., Palmyra, N. Y.

RULES, Steel

Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

RUST PREVENTIVES

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT

See Blast Cleaning Equipment

SANDERS

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersol-Rand Co., Phillipsburg, N. J.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

SAW BLADES, Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.

(*Continued on page 372*)

5203-R

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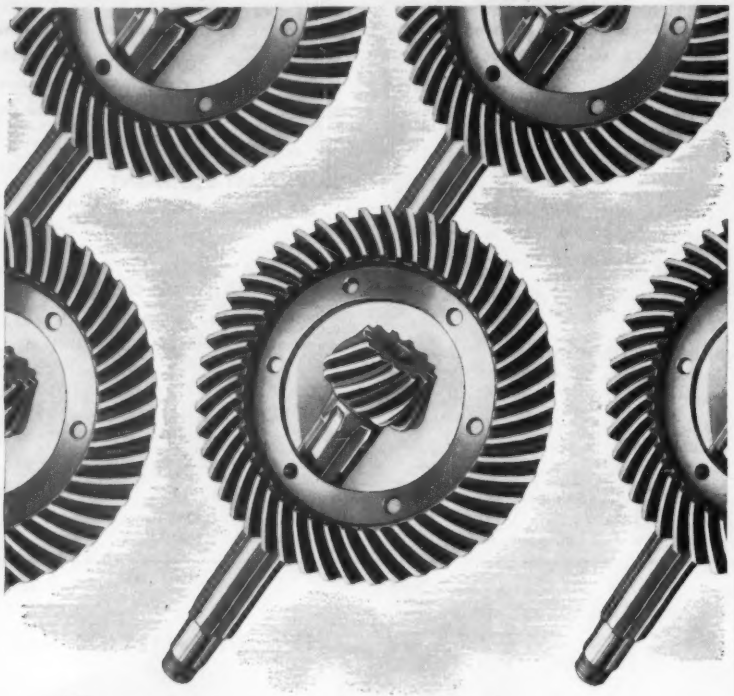

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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Wallace Tube Co., (Abrasive) 1304-08 Diversey PKwy., Chicago 14, Ill.

SAWING MACHINES, Friction

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWING MACHINES, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob, Inc., Grafton, Wis.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWS, Circular Metal Cutting

Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SAWS, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

SAWS, Portable Electric

Millers Falls Co., Greenfield, Mass.

SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

(*Continued on page* 374)

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Rotary Planer • • • do milling jobs in one-third to one-seventh of time on an Espen-Lucas Rotary Planer.

Big Sawing • • • production cutting of large stock —rapid, easy, straight-to-a-line piece after piece—on Espen-Lucas Cold Sawing Machines.

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Ingersoll-Rand Co., Phillipsburg, N. J.

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Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P.O. Box 350,
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

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Cuts Off Tubing, Pipe and Shafting . . . FAST

Cuts off longer pieces than a regular automatic machine. In fact, cuts off *any length you want*—and cuts it *faster*. If your production *requires* quantity cutting-off of tubing, pipe or shafting, check the figures below against your present time.

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This machine cuts off and chamfers both outside edges of ½" .030 wall tubing, 5" long, at the rate of one every 2.5 seconds.

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This machine cuts off and chamfers both ends of 1¼" cold rolled, 20" long, at the rate of one every 20 seconds.

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This machine cuts off and chamfers both outside edges of 3" long, at the rate of one every 3 seconds.

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National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, M. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

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Cone Automatic Mch. Co., Inc., Windsor, Vt.
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Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand

See also Lathes, Turret
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES

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Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

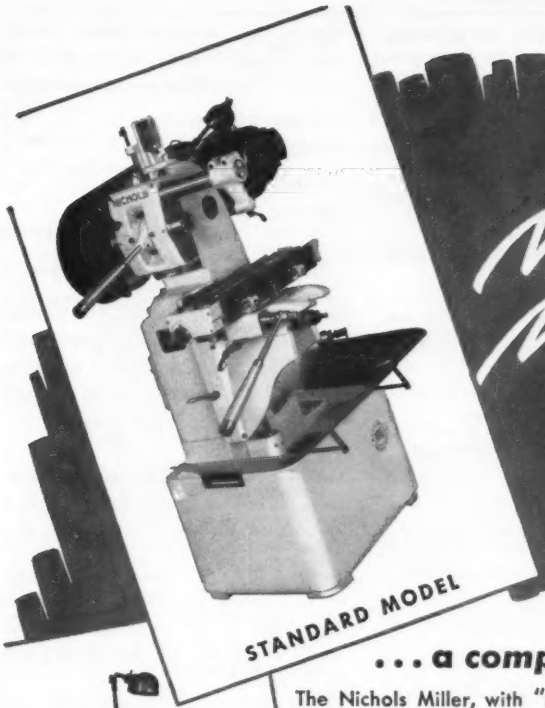
SCREWS, Self-tapping, Drive

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

SCREWS, Thumb

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page 376*)



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. . . a *complete* line

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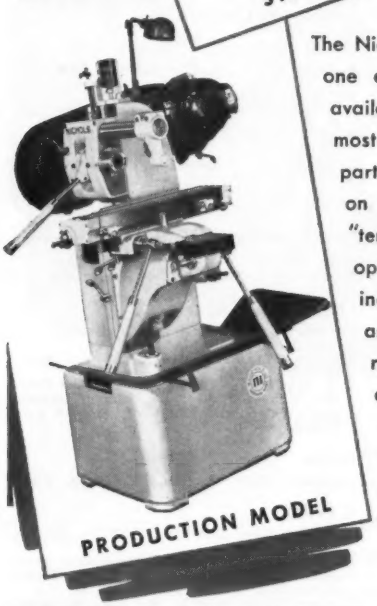

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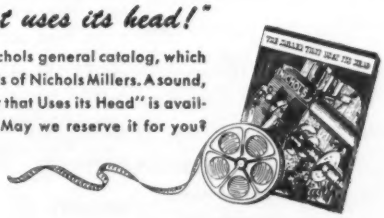
Write today for the Nichols general catalog, which describes the six models of Nichols Millers. A sound, color movie "the Miller that Uses its Head" is available for free showing. May we reserve it for you?



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Longitudinal Travel (screw or lever)	10" or 19"
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Vertical Travel — Knee	13½"
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Selective Speed Ranges up to 5000 R.P.M.	
Weight	1250 lbs.

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NEW! CLOVIS BLACK GRANITE
Rated Class A. Surface accuracy guaranteed.

FINE GRAIN SPECIAL ANALYSIS SEMI-STEEL
Precision ground or hand-scraped

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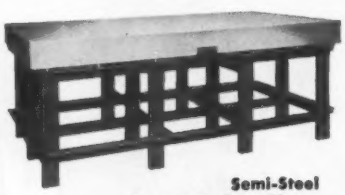

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Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

SECOND-HAND MACHINERY, Etc.
Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co., Box 770, Saginaw, Mich.

SEPARATORS, Centrifugal
De Laval Separator Co., Poughkeepsie, N. Y.

SEPARATORS, Oil or Coolant
Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

SHAFTING, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SHAFTS
Jarvis Corp., Middletown, Conn.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

SHAFTS, Hollow-Bored
Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground
Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SHAPER-PLANERS
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

SHAPERS
American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Smith & Mills Shapers, Inc., Div. Hamilton-Thomas Corp., Hamilton, O.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPES, Structural
Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.

SHEARS, Rotary
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

SHEET METALS
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
New Jersey Zinc Co., 160 Front St., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEET METAL MACHINES, Shrinking, Stretching, Forming & Flanging.
Engineering & Research Corp., Riverdale, Md.

SHEETS, Iron and Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

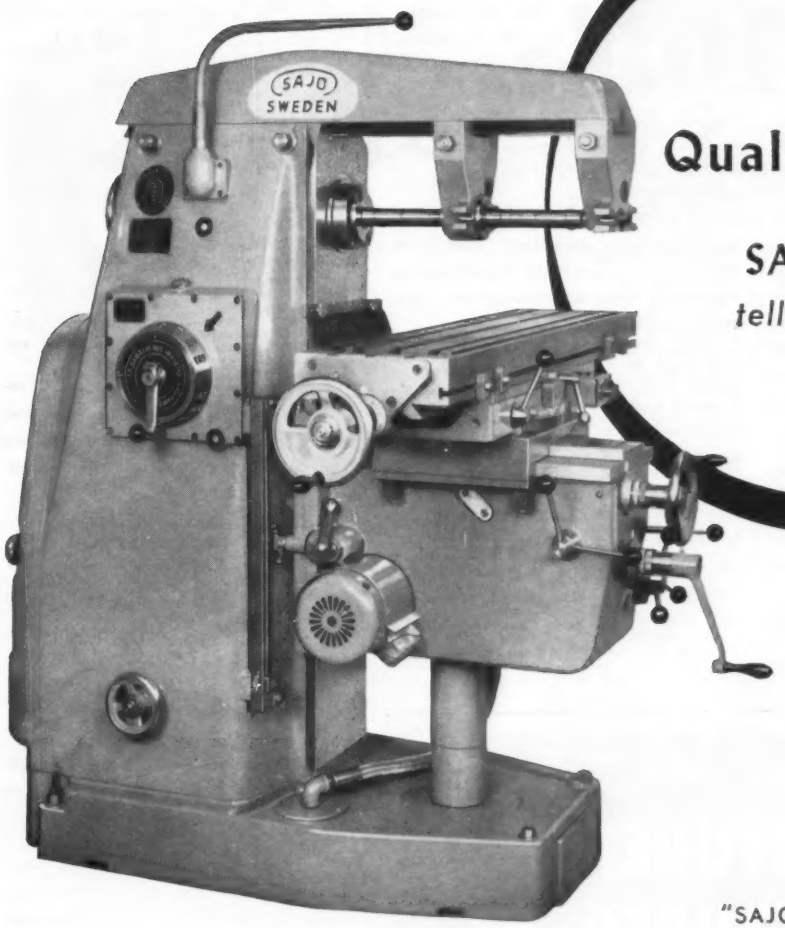
SHIMS
Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SOCKETS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.

(*Continued on page* 378)



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Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SPECIAL MACHINERY AND TOOLS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. C.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., Detroit, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
La Salle Tool Co., Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Mercury Engrg. Corp., Milwaukee, Wis.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Boston Gear Work, 320 Main St., North Quincy 71, Mass.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

SPINDLES, Boring and Milling

Pope Mchry. Corp., Haverhill, Mass.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverhill, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Winzeler Mfg. & Tool Co., 1712 W. Arcade Pl., Chicago12, Ill.

STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 Ave., Pittsburgh, Pa.
Wheeler-Lovejoy & Co., Inc., Cambridge, Mass.

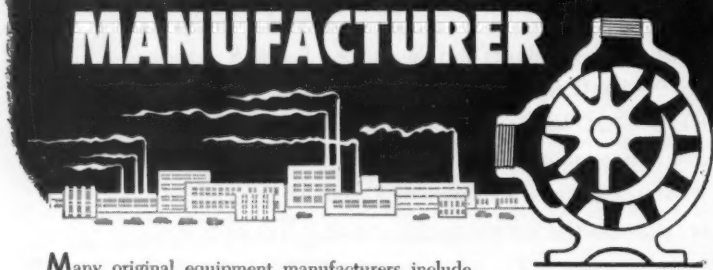
STEEL, Cold Drawn

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.

(*Continued on page* 380)

Why Viking Pump is the

MANUFACTURERS' MANUFACTURER



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By finish grinding a carefully selected crown radius on roller ends, Rollway relieves high stress areas, insures uniform distribution of load over the entire length of the roller. Rollers can take heavier loads without excessive end-fatigue, and are less subject to the effect of slight misalignment or deflection.

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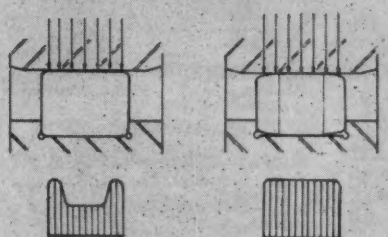
Tru-Rol Bearings with crowned rollers are available in 3 types

Stamped Steel Retainer with Guide Lips | Segmented Steel Retainer | Full Roller

Comparative Stress Patterns under Uniform Loads for Straight and Crowned Cylindrical Rollers



Stress pattern for a straight cylindrical roller under load. Note uneven end-loading.

Stress pattern for crowned roller under load. Crowning radius is exaggerated for clarity.

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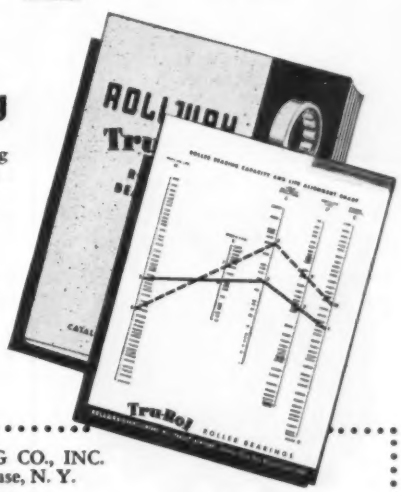

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Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co., Div., 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburgh, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS

See Alloys, Steel

STEEL BARS

See Bars, Steel

STEEL STOCK GROUND FLAT

Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

STELLITE

Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCKS, Die

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.

STONES, Oil or Sharpening

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS

Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES

Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

STRAIGHTENERS, Flat Stock and Wire

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

STUD SETTERS

Errington Mechanical Laboratory Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.

SUB-PRESSES

Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE CHECKING EQUIPMENT

Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, Ohio.
Micrometrical Mfg. Co., 321 S. Main St., Ann Arbor, Mich.

SURFACE PLATES

See Plates, Surface

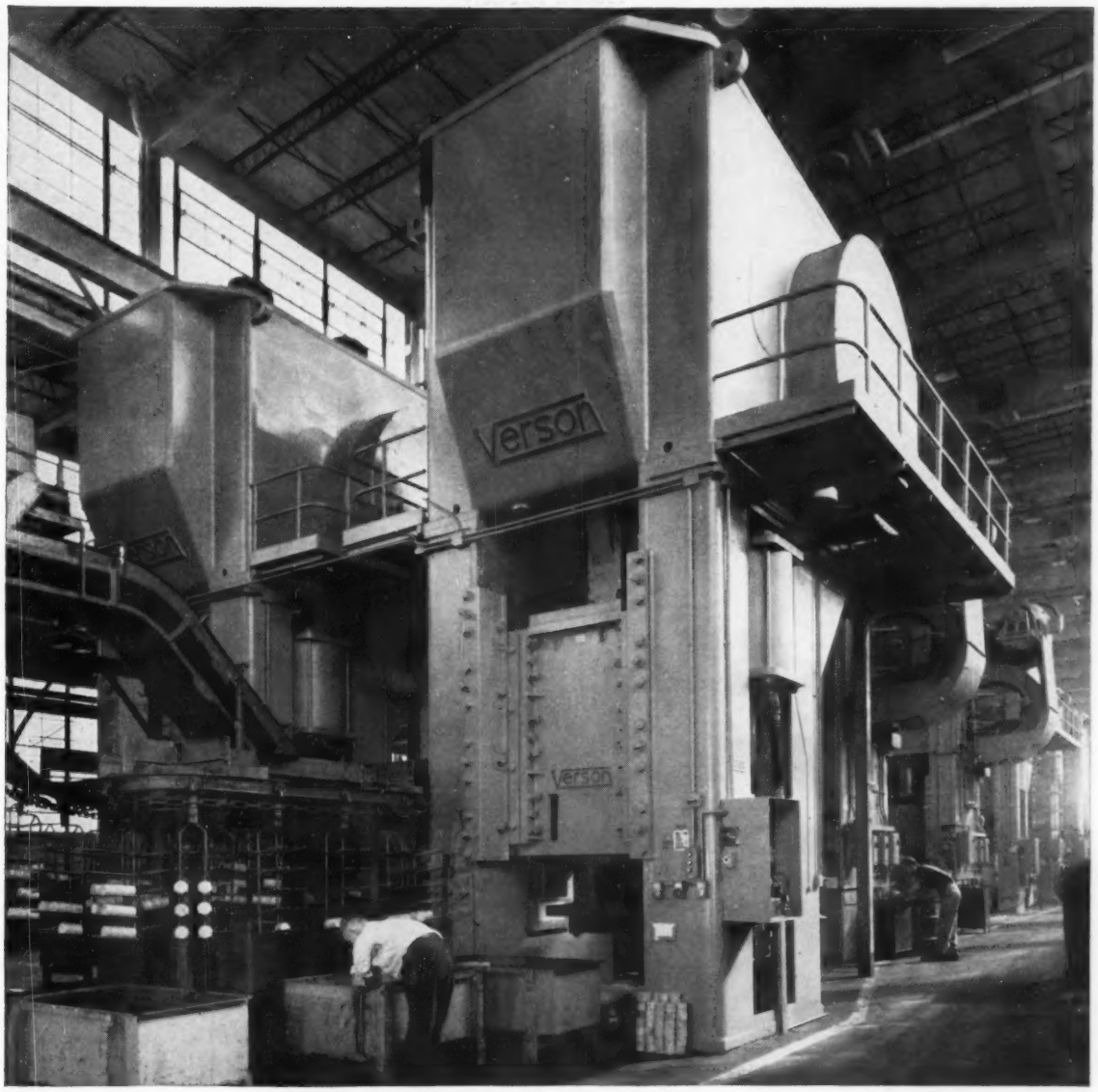
SWAGING MACHINES

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.

SWITCHES

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

(*Continued on page* 382)



Verson

ECCENTRIC PRESSES head the line at Heintz Manufacturing Company

● The two Verson Eccentric Presses illustrated above are each rated at 1500 tons with 4500 tons drive capacity. The presses are a key part of the cold extrusion lines at Heintz Manufacturing Company, Philadelphia, said by many to be "the birthplace of cold extrusion of steel in America." Both presses are specially designed with fast operating speeds to fit the production process.

Like all Verson Eccentric Presses, these represent the ultimate in mechanical press design. They provide power, strength, resistance to deflection, accuracy and efficiency unmatched by any other mechanical presses. This design coupled with Verson production know how means that when you select a Verson press, you get more than just a press. You get a production tool, tailored to your requirements as an integrated part of your production process.

It will pay you to take advantage of Verson experience in the expansion or modernization of your facilities. With a long list of advancements to its credit, Verson may be able to show you the way to lower unit production costs. For specific recommendations, send an outline of your requirements.

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TANGS, Replaceable, Drill & Reamer
Nu-Tangs Inc., 1335 Bates St., Cincinnati, Ohio.

TAPER PINS, Standard
Chicago Screw Co., Bellwood, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jarvis Corp., Middletown, Conn.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 70, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Challenge Mchry. Co., Grand Haven, Mich.
Cleveland Tapping Machine Co., 1201 Camden Ave., S. W., Canton 6, Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jarvis Corp., Middletown, Conn.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.

TAPS, Collapsing
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

TESTING EQUIPMENT, Tension, Compression, Fatigue, etc.
Olsen Tinius, Testing Mch. Co., Willow Grove, Pa.

THREAD CUTTING MACHINERY
Brown & harpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Lees-Bradner Co., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

THREAD CUTTING TOOLS
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. crew Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

THREAD GAGES
See Gages, Thread.

THREAD GRINDING MACHINES
See Grinding Machines, Thread
(*Continued on page* 384)

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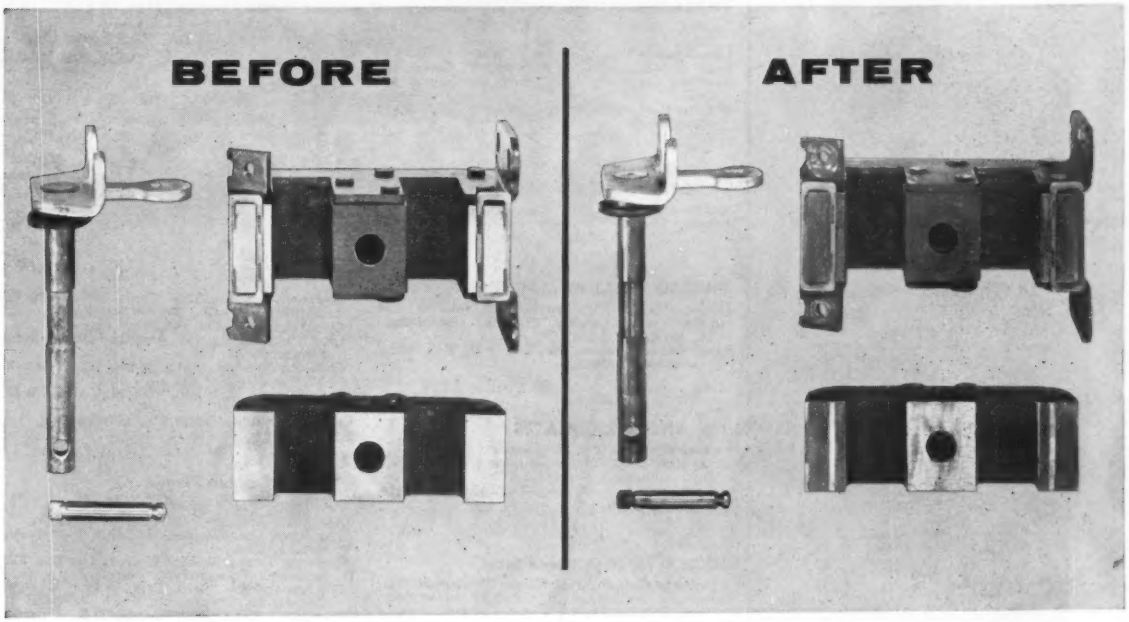


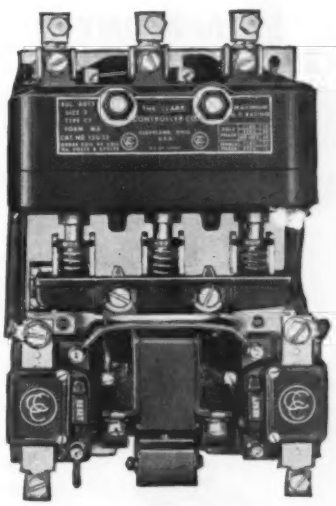
PROOF OF LONG LIFE OF CLARK TYPE "CY" STARTERS

These unretouched photos show magnet parts of a CLARK Bulletin 7707 Contactor—the contactor used on standard CLARK Bulletin 6013, Size 2, Type "CY" AC motor starters—as they looked before and after nearly 3 years of continuous service. During this time the contactor opened and closed 4 to 5 times per minute, 24 hours per day, 7 days per week—a total well over 5 million operations.

The contactor was in service at Taylor Instrument Companies, Rochester, N. Y., on a "Hevi-duty" molten salt pot electric furnace used for instrument calibration. It was installed *after several contactors of another make had failed in 4 months or less.* Our contactor was still performing perfectly when it was replaced by another identical unit, so that we could study the magnet wear.

All wearing surfaces were carefully "miked" and each dimension compared with the original. As seen in the "before and after" photos, wear was barely apparent to the naked eye. Micrometer readings showed actual wear measurable only in thousandths and ten thousandths of an inch. Only a fraction of the usable life had been consumed.

Write for descriptive literature.



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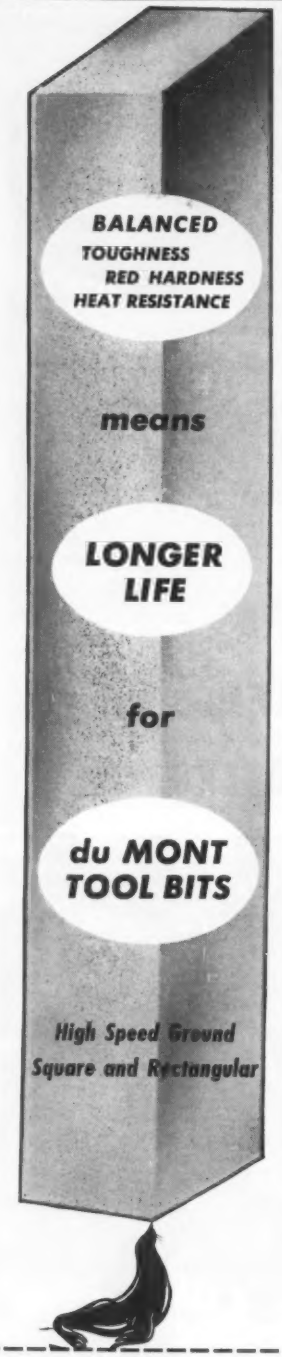

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Waltham Machine Works, Newton St., Waltham, Mass.

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National Acme Co., 170 E. 131st St., Cleveland, Ohio.

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Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besley-Welles Corp., 20 N. Wacker Drive, Chicago 6, Ill.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL BITS, Special Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1200 Woodward Heights Blvd., Ferndale, Mich.

TOOL GRINDERS

See Grinding Machines for Sharpening, Turning and Planing Tools

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOLMAKERS' INSTRUMENTS

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL RESINS

Marblette Corp., 37-33 Thirtieth St., Long Island City 1, N. Y.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped

Ace Drill Corp., Adrian, Michigan.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
The Atrax Co., (Carbide) 240 Day St., Newington 11, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Newcomer Products, Latrobe, Pa.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
du Mont Corp. Greenfield Mass.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Lathrobe, Pa.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TRANSFER MACHINES, Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

(*Continued on page* 386)

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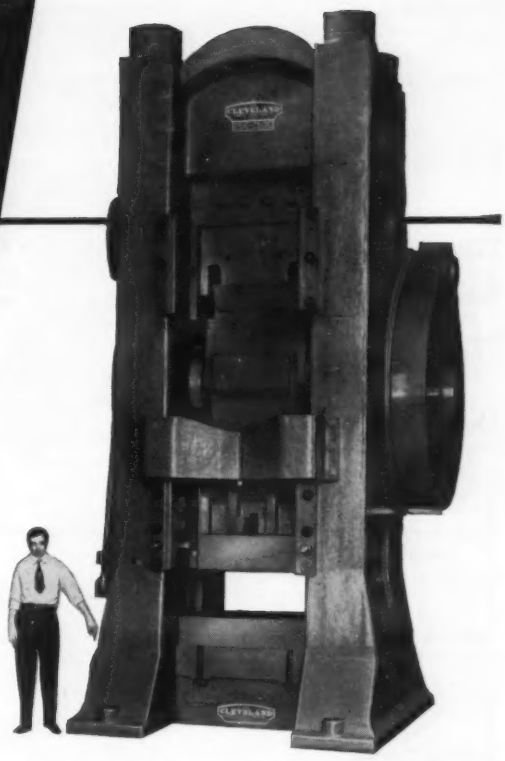

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Cleveland S1-250-36-42 Straight Sided Single Point Press 250 tons capacity

Each of the 11 specialized types of Cleveland Presses is made in a wide range of sizes. You're sure of getting the exact press to give you utmost production economy.

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TUBE FLANGING MACHINES
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TUBE FORMING AND WELDING MACHINES
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

TUBE MILLS
Abbey-Etna Co., 2444 Maplewood Ave., Toledo 10, Ohio.
Yoder Co., 550 Walworth Ave., Cleveland, Onio.

TUBE TESTING AND EXPANDING MACHINE
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.

TUBING, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

TUBING, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
National Tube Div. U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.

TWIST DRILLS
See Drills, Twist

UNIT HEATERS
L. J. Wing Mfg. Co., Linden, N. J.

UNIVERSAL JOINTS
Baush Machine Tool Co., 156 Wassen Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.

VALVE CONTROLS
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadephia, Pa.

VALVES, Air
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Lehigh Foundries, Inc., 1500 Leigh Dr., Easton, Pa.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

VALVES, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines Ill.
Hunt, C. B., & Son., 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lehigh Foundries, Inc., 1400 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

VIBRATION INSULATION
American Felt Co., Glenville, Conn.

VISES, Machine
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engineering Co., Frankenmuth 2, Mich.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

VISES, Pipe
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

VISES, Planer and Shaper
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elan and Garrard Aves., Cincinnati, Ohio.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

VOLTMETERS
General Electric Co., Schenectady, N. Y.

WASHERS, Lock
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E. Massillon, Ohio.

WASHERS, Spring
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E. Massillon, Ohio.

WELDING AND CUTTING EQUIPMENT Oxyacetylene
Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING AND CUTTING GAGES
Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING EQUIPMENT, Electric Arc
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
Federal Mch. & Welder Co., Warren, Ohio.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

WELDING EQUIPMENT, Electric, Spot, Butt, Seam, Etc.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
Federal Mch. & Welder Co., Warren, Ohio.

WELDING POSITIONER
duMont Corp., Greenfield, Mass.

WELDMENTS
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
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Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

WIPERS
Scott Paper Co., Chester, Pa.

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American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (American Steel & Wire Co. Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

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U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

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Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
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Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

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Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
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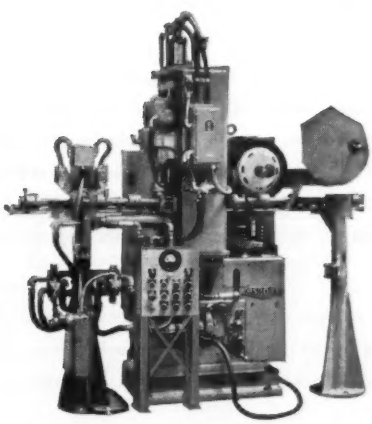

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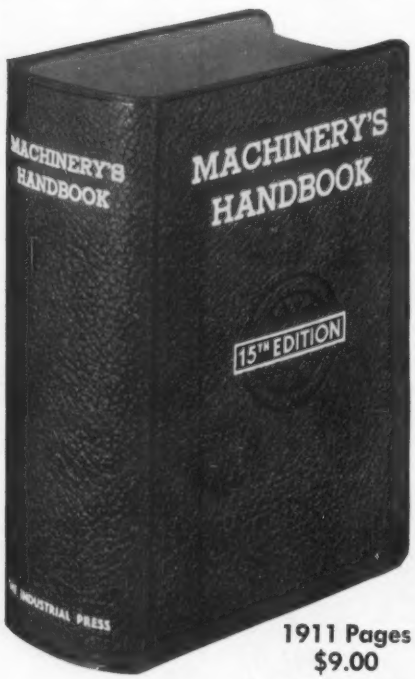

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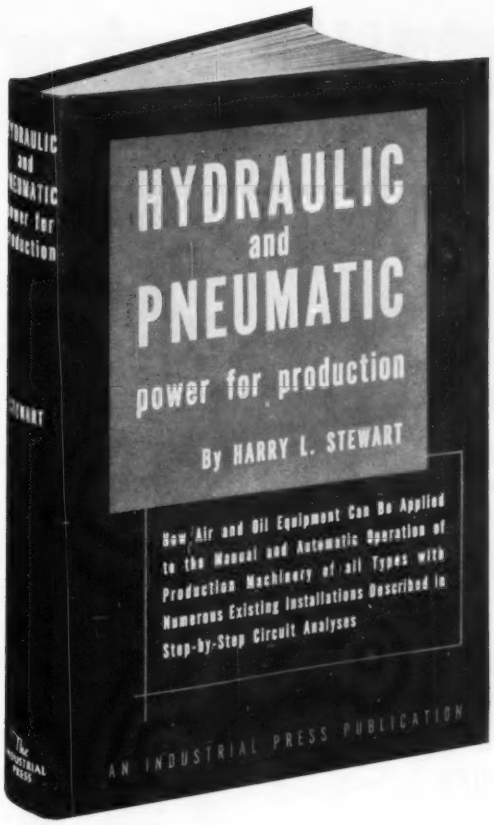
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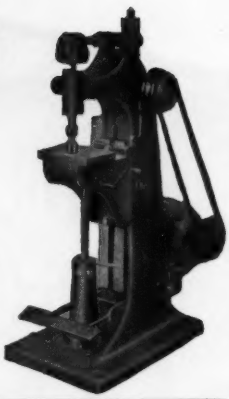

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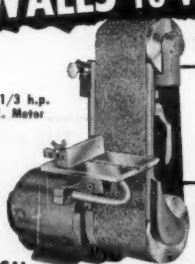

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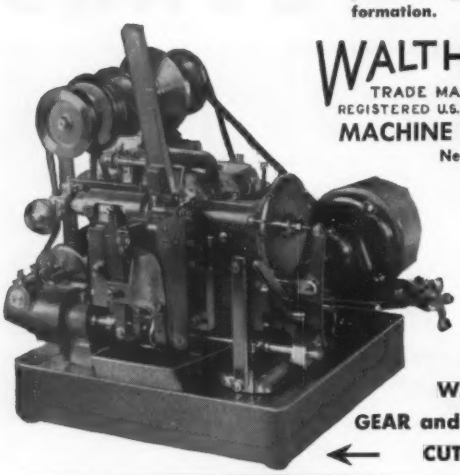

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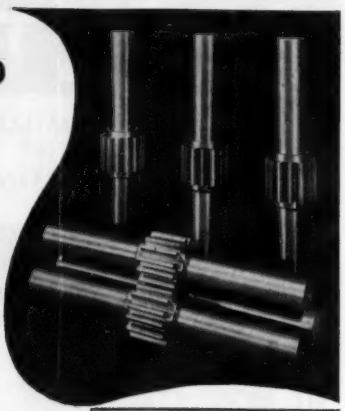

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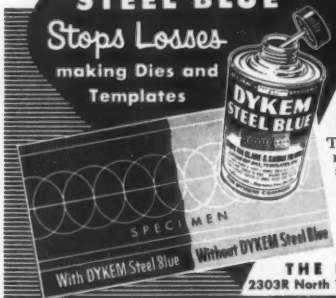

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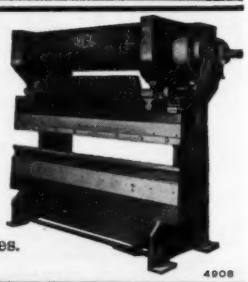

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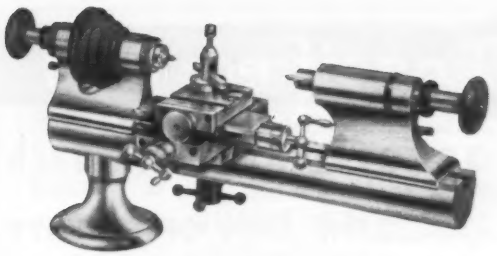

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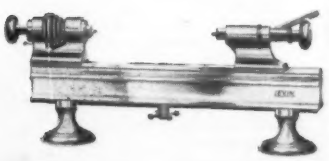

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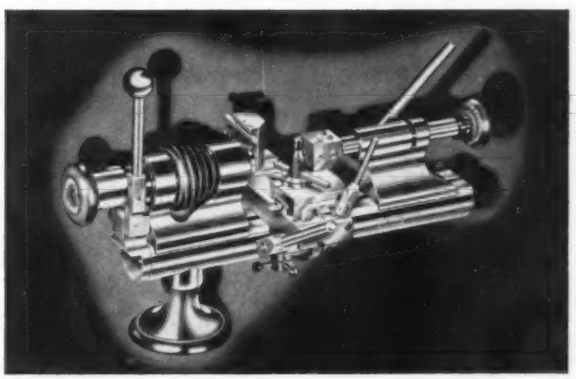

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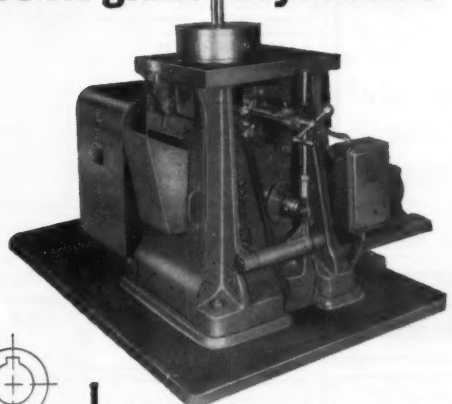

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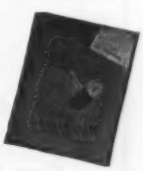

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14A Gardner Grinder, m.d.
No. 24—53" Gardner Horizontal, m.d.
No. 186—36" cap. Gardner, m.d., latest type
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6x18" Cincinnati Model EA, m.d.
6x18" Cincinnati Model ER Plain Hydraulic, m.d., Filmatic Spindle
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16x96" Cincinnati Plain Cylindrical, m.d.
18x72" Norton Type C, m.d.
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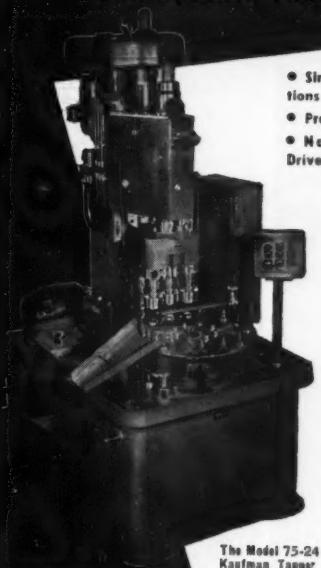

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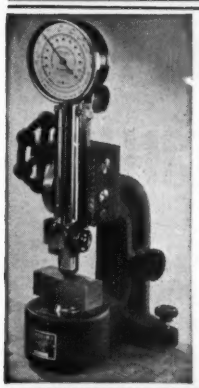

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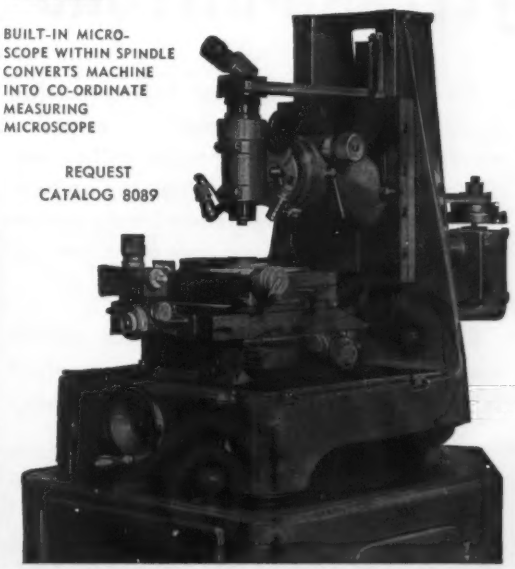

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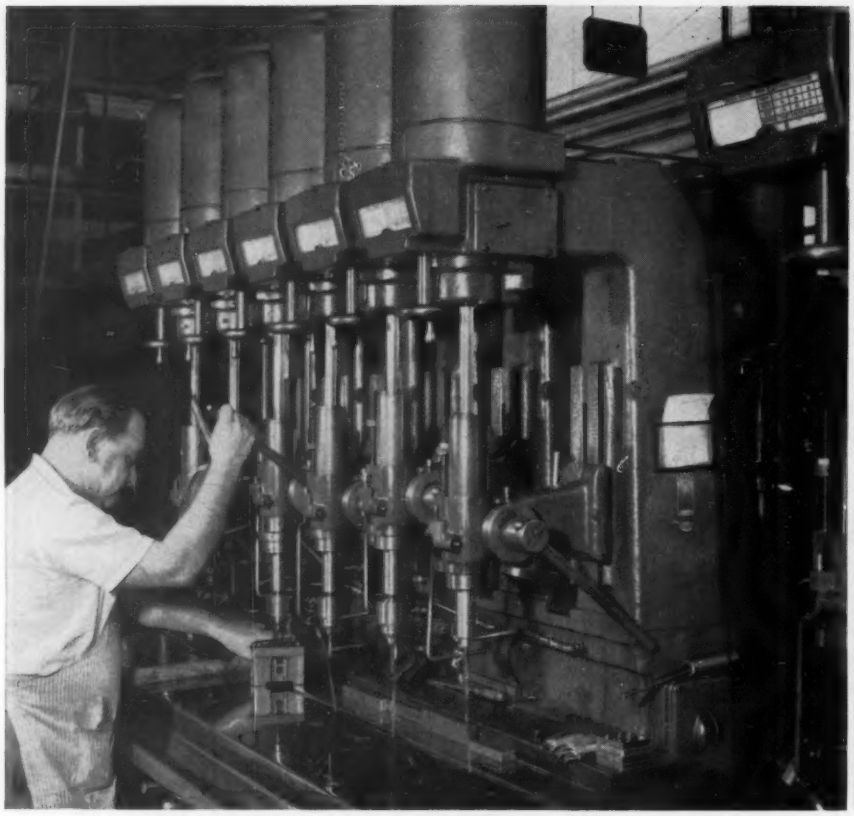

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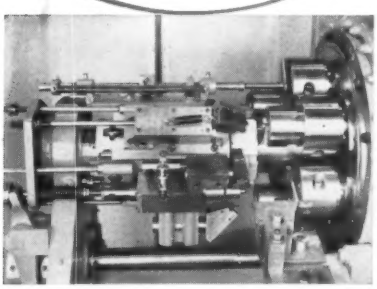
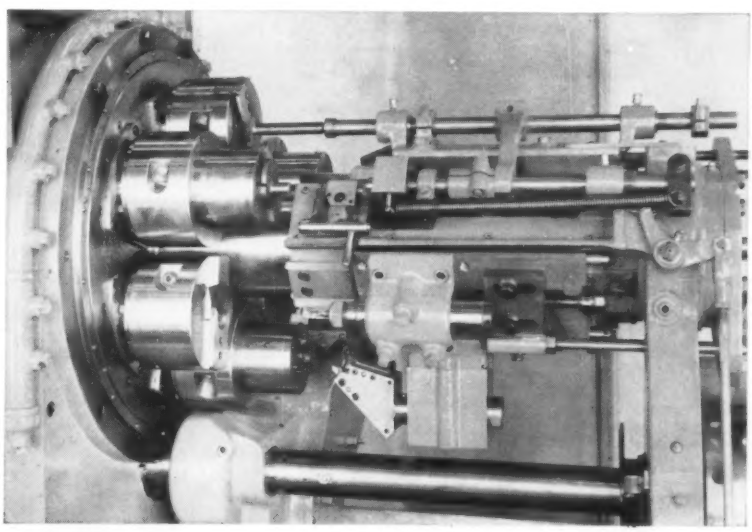


ABOVE: Rear view of tooling set-up.

RIGHT: Front view of tooling set-up.



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